Santa Clara Valley Water District

PLANNING STUDY REPORT

Lower Penitencia Creek Improvements Project

Project No. 40334005

WATERSHEDS DESIGN AND CONSTRUCTION DIVISION

May 2016

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LOWER PENITENCIA CREEK IMPROVEMENTS PROJECT

Project No. 40334005

PLANNING STUDY REPORT

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SIGNATURES

LOWER PENINTENCIA CREEK IMPROVEMENTS PROJECT

Project No.: 40334005

PLANNING STUDY REPORT

Approved by:

_____

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EXECUTIVE SUMMARY

Introduction

The main purpose of this report is to present the details of the Lower Penitencia Creek Improvements Project (Project) planning study and the staff-recommended project for meeting the project objectives.

The Project is located within the City of Milpitas and extends approximately one mile from the north at its confluence with Coyote Creek to the south at San Andreas Drive. This area of creek receives some of its water from Berryessa Creek. Construction has begun on improvements to Berryessa Creek that will bring more creek flows into this one mile stretch of creek. In its current condition, Lower Penitencia Creek cannot carry the increased flow.

This Project is necessary to ensure the increased flow can be conveyed and to maintain the current existing Federal Emergency Management Agency accreditation along the east levee located between California Circle and Berryessa Creek.

Project Objectives

The main objectives of the Project are listed here.

- Convey the Lower Berryessa Creek 1 percent design flow;
- Meet required water surface elevations at Coyote Creek and Berryessa Creek confluences;
- Minimize the need for seasonal removal of sediment and non-woody vegetation;
- Maintain existing Federal Emergency Management Agency (FEMA) accreditation along the east levee located between California Circle and Berryessa Creek; and
- Ensure the improvements meet FEMA certification requirements.

Project Alternatives

The project team identified four feasible alternatives that met the project objectives: Alternatives 1, 2A, 4 and 6. These alternatives are fully described in Chapter 5.

The key flood protection elements considered in the feasible alternatives consisted of floodwalls, levees, bridge replacements, and concrete lining. The combining of these elements distinguish the alternatives from each other. The four alternatives were evaluated via the District's Natural Flood Protection (NFP) process.

Alternatives 1, 2A, and 4 have many of the same elements, but through the NFP process, Alternative 2A scored the highest for protection from flood damage, watershed context, community benefits, and minimizing life-cycle costs.

Alternative 6 (requested by the community at the June 2014 public meeting) provided increased channel capacity through a concrete channel. However, its NFP score was significantly lower than the other three feasible alternatives because it did not have elements which are characteristic of natural flood protection.

Recommended Project

The project team recommends Alternative 2A to move forward to the design phase based on the findings of the District's NFP evaluation process as discussed in Chapter 5. Alternative 2A involves constructing floodwalls, replacing two bridges, relocating a portion of a levee and creating vegetated benches within four reaches as shown in Figure ES-1.

Sensitive Habitats and Special Status Species

Lower Penitencia Creek potentially supports the longfin smelt, tricolored blackbird, and Western pond turtle, all species of special concern. A search of the California Natural Diversity Database showed four sensitive species with recorded occurrences within the applicable species search radius and suitable habitat present at the project area: longfin smelt, salt marsh harvest mouse, San Francisco common yellowthroat, tri-colored blackbird, and Western pond turtle. Potential impacts from the project to these habitats and sensitive species associated with construction activities and modification of the existing hydraulic regime will need to be fully evaluated and discussed with applicable regulatory agencies. A variety of regulatory permits will likely be required for the project to move forward, including permits from the U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, California Department of Fish and Wildlife, and the Regional Water Quality Control Board.

Public Outreach

During the project's planning phase, the project team incorporated input from both internal and external stakeholders into the development of the feasible alternatives.

Right of Way Acquisition Required for Project Construction

It is expected that the parcel of land downstream of I-880 on the south bank would need to be acquired by the District in fee for the construction of Alternative 2A.

Estimated Cost, Financing, and Schedule

The estimated cost for project design and environmental documentation for the staff-recommended project is $3.5 million. The estimated cost of construction is $21 million in 2015 dollars. Based on the current construction cost escalation rate in the District's Capital Improvement Plan, the cost to construct this project beginning in 2018 is estimated at $23 million plus an additional $70,000 for land acquisition[1].

Funding for this project is anticipated to be allocated partially from the California Department of Water Resources Proposition 1E, Round 2 Stormwater Flood Management Grant 4600010375. The total grant of $30 million would be used toward subsidizing the Lower Berryessa, Lower Penitencia, and Upper Berryessa improvements. The rest of the funding for this project would be allocated from the District's Stream Stewardship funds.

In addition, annual maintenance for the staff-recommended project is expected to cost $87,000 (2015 dollars). The total maintenance cost over the 50-year life span of the project, assuming a compounding inflation rate of 3% and an effective interest rate of 2.5%, would be $5.0 million

[1] Based on unit cost provided by the Real Estate Services Unit for Agriculture/Parks/Recreation. Parcel area is 1.43 acres. This is a District cost estimate and will need to be negotiated with the City of Milpitas.

(2015 dollars). Project design is expected to begin in June 2016 and the plans, specifications, and cost estimate are anticipated to be adopted by the board in March 2018. Construction would begin in June 2018.

Project Implementation

After approval of this Planning Study Report, the following milestones have been developed as next steps for project implementation:

- Commence design plans and specifications preparation: June 2016
- Certify Environmental Impact Report: July 2017
- District approves design plans and specifications: March 2018
- Complete permit acquisition: March 2018
- Commence construction: June 2018

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Figure ES-1. Reach map for the Staff-Recommended Project (Alternative 2A)

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CHAPTER 1. INTRODUCTION

1.1 Purpose and Organization of the Planning Study Report

This Planning Study Report (Report) for the Lower Penitencia Creek Improvements Project documents the project's problem definition, the development and evaluation of project alternatives, and the resulting staff-recommended project. This Report also provides a brief summary of anticipated construction activities, project funding, acquisition of permits, and planned schedule for the staff-recommended project.

To assist the reader, the Report has been organized as follows:

- Chapter 1: Project Origin, Objectives, and Location
- Chapter 2: Study Background
- Chapter 3: Problem Definition
- Chapter 4: Project Outreach, including regulatory requirements
- Chapter 5: Formulation and Evaluation of Alternatives
- Chapter 6: Staff-Recommended Project
- Chapter 7: Maintenance Program
- Chapter 8: Project Cost, Funding Sources, and Schedule
- Chapter 9: References

1.2 Project Origin

Lower Penitencia Creek is situated in the northeasterly portion of Santa Clara County within the City of Milpitas in the Berryessa Creek watershed. Lower Penitencia Creek is a trapezoidal open channel with both earth- and concrete-lined sections. To increase channel capacity, improvements were constructed in 1955, 1962, 1965, and 1984. Lower Penitencia Creek's east levee, located between California Circle and Berryessa Creek, is certified by the Federal Emergency Management Agency (FEMA). Two tributaries, Berryessa Creek and Penitencia East Channel, flow into Lower Penitencia Creek. Lower Penitencia Creek itself flows into Coyote Creek.

As shown in Figure 1-1, the District has two capital flood protection projects located immediately east of Lower Penitencia Creek, the Lower and Upper Berryessa Creek Projects. Completion of improvements along the Lower and Upper Berryessa Creek Projects will result in an increase to the Lower Penitencia Creek Improvement Project's 1 percent design flow. Lower Penitencia Creek, in its existing condition, lacks capacity to convey the increased 1 percent design flow.

Construction of Lower Berryessa Creek Project Phase 1 (Lower Penitencia Creek to downstream of Abel Street) began in summer 2015 and is scheduled to be completed in 2017. Lower Berryessa Creek Phase 2 consists of two parts: (1) Lower Berryessa Creek (downstream of Abel Street to Calaveras Boulevard) will begin construction in summer 2016 and is scheduled to be completed in 2017, and (2) Lower Calera Creek (Union Pacific Railroad to an existing drop structure approximately 3,000 feet upstream of the confluence with Berryessa Creek) will be constructed by 2018. The Upper Berryessa Creek Project (Calaveras Boulevard to I-680) is scheduled to complete construction in 2017. Lower Penitencia Creek construction must be completed within the same time frame as the Lower and Upper Berryessa Creek Projects to avoid inducing downstream flooding. Lower Penitencia Creek construction is

also necessary to ensure its FEMA-certified east levee does not become decertified resulting in a portion of the community being placed back into FEMA's 1 percent floodplain.

1.3 Project Objectives and Relevant Board Ends Policy

The objectives of the Project are listed below:

- Convey the Lower Berryessa Creek 1 percent design flow;
- Meet required water surface elevations at Coyote Creek and Berryessa Creek confluences;
- Minimize the need for seasonal removal of sediment and non-woody vegetation;
- Maintain existing Federal Emergency Management Agency (FEMA) accreditation along the east levee located between California Circle and Berryessa Creek; and
- Ensure the improvements meet FEMA certification requirements.

This Project is being conducted under the District's mission to provide Silicon Valley safe, clean water for a healthy life, environment, and economy. The Project's relevant Board Ends policy is E 3.1—Provide natural flood protection for residents, businesses, and visitors.

1.4 Project Limits and Location

The Project is located in the City of Milpitas and extends from the Coyote Creek confluence upstream to San Andreas Drive. The total project length is approximately one mile.

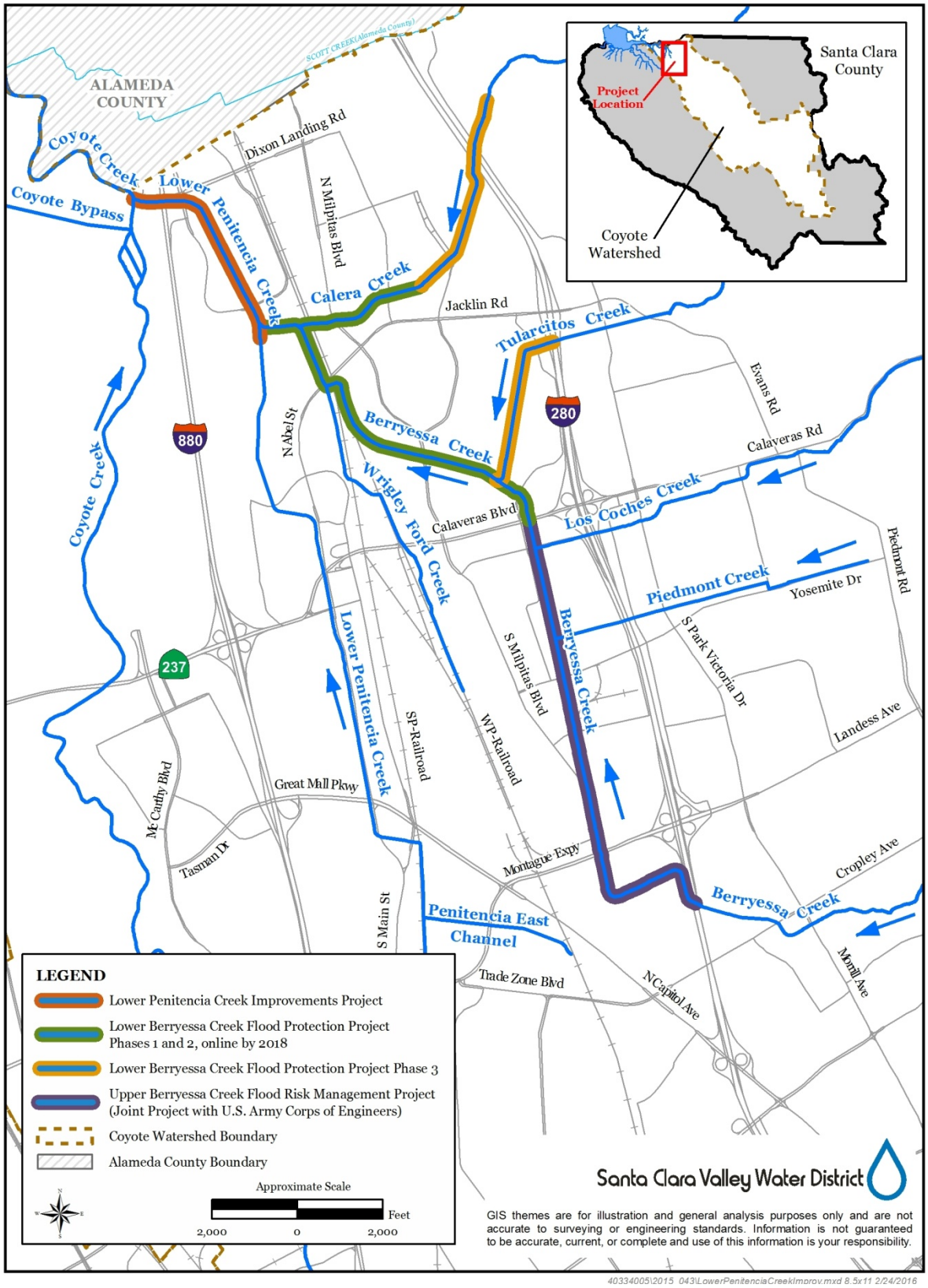

Figure 1-1. Map of Lower Penitencia Creek and Berryessa Creek

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CHAPTER 2. STUDY BACKGROUND

This chapter provides descriptions of the Lower Penitencia Creek watershed. Information on the channels, watershed hydrology, geology, utilities, biological resources, hazardous materials, and related projects is provided in the following sections.

2.1 Description of Project Reaches

For planning purposes, the Lower Penitencia Creek Project length has been divided into four reaches, as shown in Figure 2-1. Lower Penitencia Creek is, for the most part, a trapezoidal open channel that contains both earthen and concrete-lined sections. Most of the length of Reach 3 consists of a primary and secondary channel separated by a central island.

Four bridges cross the creek in the project limits. They are, from downstream to upstream, the southbound on-ramp to Interstate 880 (I-880), I-880, California Circle, and Milmont Drive.

There are two pump stations within the project limits: California Circle Pump Station and Abbott Pump Station. A third pump station, Jurgens Pump Station, discharges to Lower Penitencia Creek, but the pump station itself is not within the project limits.

The channel has been divided into four reaches as defined below and delineated in Figure 2-1:

Reach 1—Confluence with Coyote Creek to the upstream face of I-880 Bridge (600 linear feet)
Reach 2—I-880 to the upstream face of California Circle Bridge (500 linear feet)
Reach 3—California Circle to the upstream face of Milmont Drive Bridge (3,000 linear feet)
Reach 4—Milmont Drive to the downstream face of San Andreas Drive Bridge (800 linear feet)

More detailed descriptions of the reaches, including channel dimensions, are noted in the following sections.

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Figure 2-1: Project Reaches

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2.1.1 Reach 1

Reach 1 extends approximately 600 feet from the confluence with Coyote Creek to the upstream face of the I-880 Bridge.

At the confluence with Coyote Creek, the channel bottom is rock lined with ¼-ton boulders 3 feet deep overlaid on geotextile fabric. From the confluence to approximately 200 feet downstream of I-880, the creek is an earth trapezoidal channel with a levee on the south bank and an embankment on the north bank parallel to Dixon Landing Road. The top width of the south levee is 18 feet. The levee was constructed with improvements to Coyote Creek, and was required to maintain the standards of the U.S. Army Corps of Engineers. Therefore, it is inspected and maintained as part of Coyote Creek. Channel bottom varies between approximately 55 feet and 70 feet. See Photos 2-1 to 2-5.

From approximately 200 feet downstream of I-880 to upstream of I-880, the creek is a concrete lined trapezoidal channel. There is a concrete ramp on the south bank. Channel bottom width in this portion of the creek ranges from 55 to 82 ft.

Photo 2-1. Reach 1, looking downstream at confluence with Coyote Creek

Photo 2-2. Reach 1, looking upstream at I-880 on-ramp and I-880

Photo 2-3. Reach 1, looking upstream, south overbank

Photo 2-4. Upstream face of I-880, looking downstream, south bridge cell

Photo 2-5. Reach 1 at I-880, looking upstream, south bridge cell

2.1.2 Reach 2

Reach 2 extends approximately 500 feet from the upstream face of the I-880 Bridge to the upstream face of the California Circle Bridge.

From I-880 to California Circle (and continuing about 170 feet upstream of California Circle into Reach 3), the creek is a concrete-lined trapezoidal channel with levees on both banks. Both the north and south levees have an 18-foot top width. Just downstream of the California Circle bridge on the south bank is an outfall: three 28-inch-diameter high-density polyethylene pipes which discharge flow from the California Circle pump station (Schaaf & Wheeler, 2013). Vehicular access from California Circle to the pump station needs to be preserved in any future channel improvements. Channel bottom width in Reach 2 is 55 feet.

The California Circle bridge crosses Lower Penitencia Creek. It is a clear span bridge, and the existing bridge opening across the creek is approximately 100 feet.

Photo 2-6. Reach 2, standing on California Circle Bridge looking downstream at I-880

Photo 2-7. California Circle bridge, downstream face

2.1.3 Reach 3

Reach 3 extends approximately 3,000 feet from the upstream face of the California Circle Bridge, to the upstream face of the Milmont Drive Bridge. From California Circle to approximately 170 feet upstream, Lower Penitencia Creek is a concrete-lined trapezoidal channel with a bottom width of 55 to 70 feet.

Starting at approximately 170 feet upstream of California Circle, the creek splits into two earthen channels separated by a central island, which extend upstream for about 2,400 feet. The bottom widths of the primary and secondary channels are about 41 feet and 22 feet, respectively. The top width of the center island is approximately 18 feet; it serves as a maintenance road. Between Milmont Drive bridge and about 240 feet downstream the channel is lined with concrete.

This creek reach is bounded by earth levees (approximately 12-foot top width) on both banks. The crest of the east levee is paved with asphalt and supports a City of Milpitas recreational trail. There is an 18-foot-wide depressed maintenance road along the inboard east levee. A 72-inch diameter outfall for the City of Milpitas Jurgens Pump Station discharges on the east bank in this reach (Schaaf & Wheeler, 2013). An existing boat launch ramp located on the west bank is accessible from California Circle.

The ramps that lead from California Circle and Milmont Drive to the center island are all paved concrete.

The east levee has been certified by the Federal Emergency Management Agency (FEMA). In 2007, the District began recertification efforts under FEMA's Map Modernization Program. As part of the recertification effort, AMEC Geomatrix Inc. was hired to undertake the geotechnical investigation. AMEC produced a report in 2009 documenting the investigation, which concluded that there were no geotechnical issues that would prevent recertification. FEMA updated the Flood Insurance Rate Map to reflect the results. The approximate length of the recertified levee is 3,400 feet.

At approximately 240 feet downstream of the Milmont Drive bridge, the creek again becomes a single concrete-lined trapezoidal channel.

The Milmont Drive bridge crosses Lower Penitencia Creek. It is a clear span bridge, and the existing bridge opening across the creek is approximately 100 feet.

Photo 2-8. Reach 3, just upstream of California Circle, looking upstream at the start of the dual channel

Photo 2-9. Reach 3, standing on Milmont Drive looking downstream at the dual channel

Photo 2-10. Milmont Drive, downstream face

2.1.4 Reach 4

Reach 4 extends approximately 800 feet from the upstream face of the Mimont Drive Bridge to the downstream face of the San Andreas Drive Bridge. From the Milmont Drive bridge to San Andreas Drive, the creek is a concrete-lined trapezoidal channel. Earth levees are present on both banks and have paved roadways on their crests. Channel bottom width is about 60 feet. As noted in the description of Reach 3 above, the east levee was recertified by FEMA as part of the agency's Map Modernization Program. FEMA's current flood hazard maps reflect the certified status of this levee.

Just upstream of the Berryessa Creek confluence there are two outfalls on the west bank. These two 18-inch diameter polyethylene pipes discharge stormwater runoff from the Abbott Avenue pump station (Schaaf & Wheeler, 2013). Access to the pump station would need to be provided after construction of a floodwall over the existing levee. Currently, there are no flap gates on the discharge pipes; the need for flap gates should be explored with the City of Milpitas.

Photo 2-11. Reach 4, standing at Milmont Drive looking upstream at Berryessa Creek confluence

Photo 2-12. Reach 4 at Lower Berryessa Creek confluence, looking downstream

Photo 2-13. Reach 4, upstream of confluence with Lower Berryessa Creek looking upstream at San Andreas Bridge

2.2 Hydrology and Hydraulics

2.2.1 Historical Background

Up until the mid-1800s, Lower Penitencia Creek was seasonally connected to Upper Penitencia Creek (SFEI, 2012). The two creeks were separated by a substantial complex of willow groves, seasonally flooded wetlands, and freshwater marsh, stretching along the east side of Coyote Creek from today's Murphy Avenue southward past Mabury Road. As Upper Penitencia Creek sunk into this marsh, it lost definition as a creek but then came out as a creek again as Lower Penitencia Creek. During summer months, there would have been no surface connection between the two creeks. During winter months, they would be connected from high flows through this marsh complex.

Around 1851, a local landowner dug a ditch from the mouth of Upper Penitencia Creek through the willow groves to Coyote Creek to reduce wintertime flooding at the mouth of the creek, but it had the added effect of connecting Upper Penitencia Creek to Coyote Creek for the first time. Over time, this connection became the sole flow pathway and the two Penitencia Creeks became permanently separated.

The District improved the portion of Lower Penitencia Creek from the confluence with Coyote Creek to State Route 237 in 1955, the portion from State Route 237 to Sylvia Avenue in 1962, and the portion from Sylvia Avenue to South Main Street in 1965.

A Lower Penitencia Creek Planning Study and Engineer's Report was prepared in 1982. The existing channel in the project reach was improved at multiple locations in the 1980s. In 1983, property west of the creek and south of Dixon Landing Road was developed, becoming Dixon Landing Business Park (Reimer Associates, April 1983). The development included improving the channel between Interstate 880 and Berryessa Creek confluence. A levee was built on the south side of the creek between Interstate 880 and California Circle. A secondary channel and a depressed center island topped with a maintenance road were constructed between California Circle and Milmont Drive. A west levee was constructed between California Circle and the Berryessa Creek confluence.

In 1984, the District reconstructed the channel with concrete under Interstate 880.

In 1988, property east of the creek and south of Dixon Landing Road was developed, becoming California Landing (Reimer Associates, September 1988). The development included improving the channel between California Circle and the Berryessa Creek confluence, and constructing the Milmont Drive bridge (Reimer Associates, December 1988). The main channel was widened and a depressed maintenance road (along the east levee) was constructed between California Circle and Milmont Drive. At the same time, east levees were constructed between California Circle and the Berryessa Creek confluence.

In 1989, the channel downstream of Interstate 880 was widened and a south levee was constructed as part of the Coyote Creek Reach 1 improvements.

In 2001, Caltrans reconstructed the interchange at Dixon Landing Road and Interstate 880 within the Cities of Milpitas and Fremont. The project consisted of constructing a new Dixon Landing Road, a newly widened Interstate 880 freeway structure, and new freeway access

ramps. Both the new freeway bridge and the new southbound on-ramp bridge cross over the creek.

The data sources used for the HEC-RAS models include survey data collected in 2010, 2012, 2013 and 2015 by Santa Clara Valley Water District, bridge parameters developed from the 2012 survey, and construction as-builts. Manning's n-values were assigned based on field observations and downstream boundary conditions modeling studies conducted by project team.

2.2.2 General Watershed Description

Lower Penitencia Creek is located in the northeasterly portion of Santa Clara County within the City of Milpitas. In its entirety, it is about four miles long and flows northerly from two large outfalls at Montague Expressway to its confluence with Coyote Creek near the intersection of Interstate 880 and Dixon Landing Road. The creek is tidally influenced from Coyote Creek to approximately Marylinn Drive.

Its watershed lies in the unincorporated area of the County and in the Cities of Milpitas and San Jose. The total watershed area is about 29 square miles, with about 16 square miles lying on the valley floor and the remainder in the hills of the Diablo Range. The Lower Penitencia Creek watershed has no reservoirs.

As shown in Figure 2-2, two tributaries, Berryessa Creek and Penitencia East Channel, flow into Lower Penitencia Creek. Lower Penitencia Creek itself flows into Coyote Creek. Berryessa Creek is the major drainage channel for the mountainous portion of the Lower Penitencia Creek watershed.

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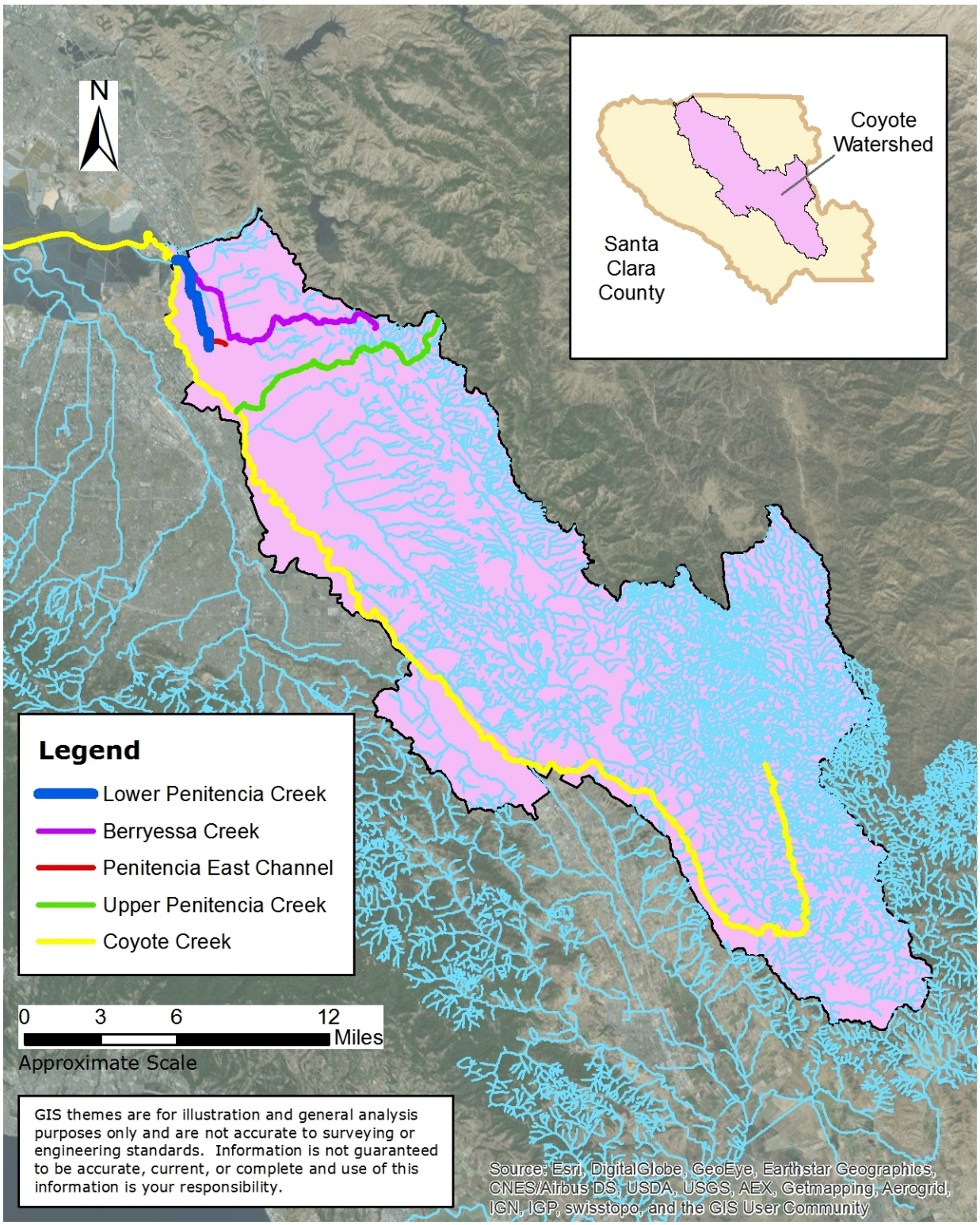

Figure 2-2. Coyote Watershed Boundary

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2.2.3 Design Flows

The 100-year design flows (shown in Table 2-1) for the Project are from the 2006 Berryessa Creek Watershed Hydrology Report prepared for the District and the U.S. Army Corps of Engineers (Corps).

Table 2-1. 100-Year Design Condition Flowrates

Location	Cumulative Drainage Area (mi^2)	Peak Flowrate (cfs)
Coyote Creek		
At Lower Penitencia Creek confluence		12,200
Lower Penitencia Creek		
Upstream of Coyote Creek confluence	29.1	8,720
Downstream of Berryessa Creek confluence	28.2	8,400

The 100-year flow rates for Coyote Creek used to determine the downstream boundary condition are documented in the District's 2015 technical memorandum recommending the flow scenario for Coyote Creek to be used for the Lower Penitencia Creek Project.

2.2.4 Pump Stations

The City of Milpitas operates four pump stations that discharge collected storm water to Lower Penitencia Creek. Three of the pump stations discharge to the Project area:

- California Circle Pump station (City of Milpitas Facility No. SD-1)
- Jurgens Pump Station (City of Milpitas Facility No. SD-2)
- Abbott Pump Station (City of Milpitas Facility No. SD-4)

A fourth pump station, the Penitencia Pump Station (City of Milpitas Facility SD-6), is located upstream of the project area and drains the Hall Park Lagoon to Lower Penitencia Creek. These facilities are shown in Figure 2-3. The flow distribution shown in Table 2-1 incorporates pump station discharges through elevation/volume-outflow curves.

The California Circle pump station drains the California Circle lagoon, a 2.5-acre stormwater retention pond at the intersection of Dixon Landing Road and I-880. The lagoon collects runoff from a total area of 263 acres, and discharges to Lower Penitencia Creek through three 28-inch pipes. The discharge pipe invert elevation is 13.8 feet NAVD (Schaaf & Wheeler, 2013), which is lower than the future 100-year water surface elevation. The need for modifications to the discharge pipe will be explored during the design phase.

Currently, the Jurgens Pump Station is undersized, and stormwater will pond in Dixon Landing Park during a 10-year storm event or greater.

The Abbott pump station is connected to the Abbott Lagoon, and is described in the City of Milpitas Storm Drain Master Plan as follows:

Located on Abbott Avenue, the facility serves as a recreational and aesthetic feature inside an industrial park…Abbott Pump Station discharges to Penitencia Creek via twin 18-inch diameter high density polyethylene outfalls through the western levee without flap gates (Schaaf & Wheeler, 2013).

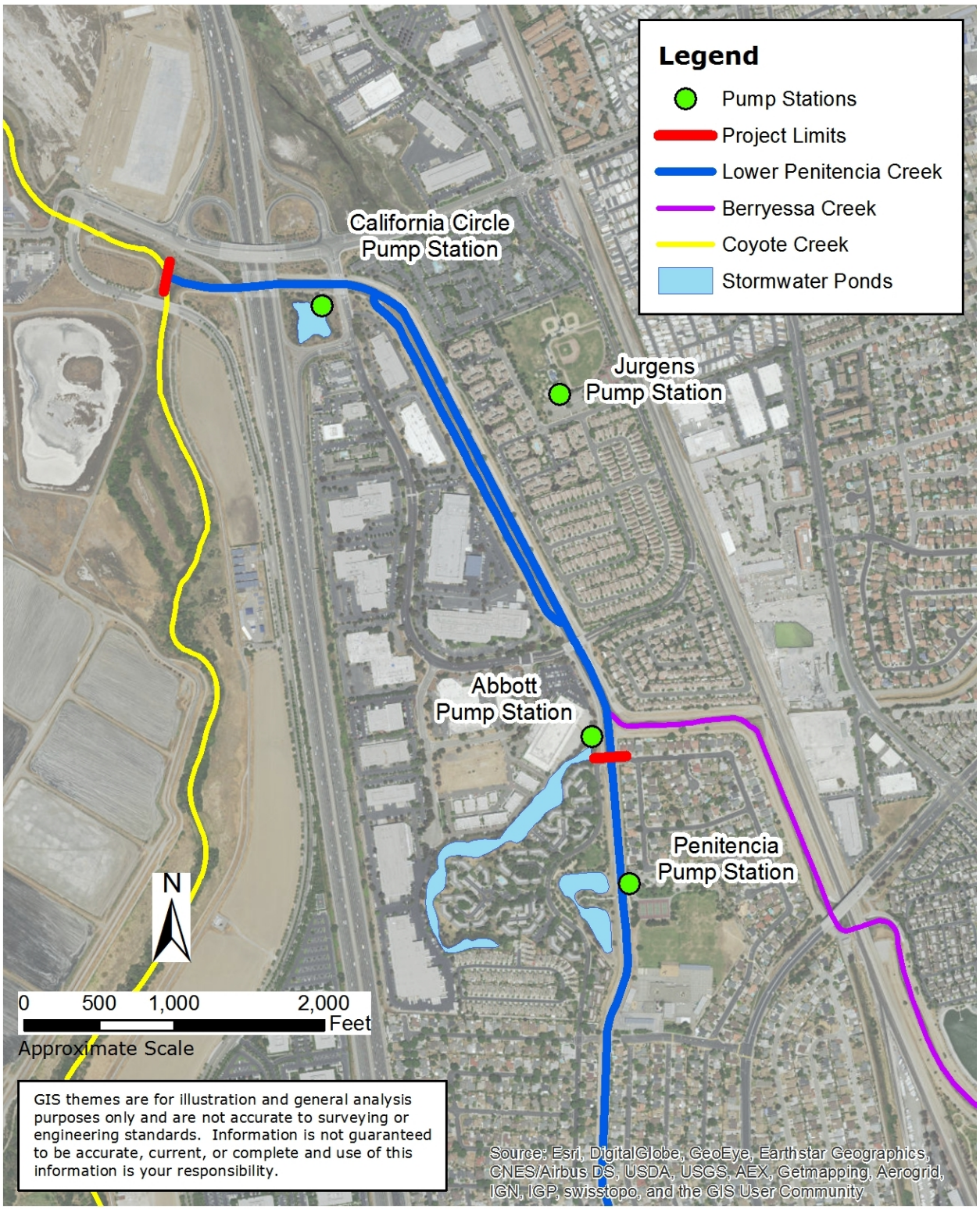

Figure 2-3. Pump Stations in Project Vicinity

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2.2.5 Tidal Influence

Lower Penitencia Creek is a tidally influenced tributary to Coyote Creek located near South San Francisco Bay, and receives incoming sediment with daily tidal episodes. It is a goal of this project to design flood protection improvements that allow for the tidally related sediment load to remain. The tidal influence within the Project area was documented in a May 2015 (revised January 2016) District memo, "Identifying Tidal Range in Lower Penitencia Creek." This is discussed further in Chapter 3, Problem Definition, Section 3.2, Sediment Deposition and Tidal Influence.

2.2.6 Boundary Conditions and Sea Level Rise

Lower Penitencia Creek's 1 percent boundary water surface elevation must conform to the 1 percent water surface elevation of its confluence points with Coyote Creek and Berryessa Creek. The water surface elevation at the Berryessa Creek confluence point must not be exceeded. Lower Penitencia Creek would also be subject to future sea level changes. This has been taken into consideration in the project's design criteria for its starting water surface boundary condition. Low, intermediate, and high sea level changes were examined for a 50-year projection period (to Year-2070). The basis for these sea level rise projections is the Coyote Creek tide station analysis in the U.S. Army Corps of Engineers South San Francisco Bay Shoreline Phase I Study, which encompasses the Project area.

A memorandum dated 9/27/1990 discussed the starting water surface elevation at Lower Penitencia Creek's confluence with Coyote Creek. According to the memo, a 2-D model that was performed prior had shown that the water surface elevation at that location to be 11.2 NGVD (approximately 14 NAVD88). This starting condition was re-confirmed in 2015.

2.3 Geology

The Santa Clara Valley is an elongated northwest-southeast trending valley in the Central Coast Ranges geomorphic province of California. The valley is a structural depression bounded by active faults: the San Andreas Fault to the west and southwest and the Hayward and Calaveras faults to the north and east (Helley and Westing 1989). South San Francisco Bay is to the north. The valley ranges from 0 to 500 feet in elevation above mean sea level (msl) and the mountains to the east and west rise to about 4,000 feet msl.

The entire project area is underlain by Holocene floodplain deposits (i.e., less than 10,000 years in age) consisting of medium to dark gray dense sandy to silty clay. Lenses of coarser materials consisting of silt sand, or pebbles are also locally present. These sediments were deposited as sea level rose during retreat of continental glaciers. Rising sea level steadily pushed the shoreline of South San Francisco Bay southward, causing deposition of floodplain deposits in the adjoining tidelands and valley floor (Helley and Westing, 1989).

The Natural Resources Conservation Service maps soil of the project area as Urbanland-Campbell complex on 0 to 2% slopes. This soil forms on alluvial fans and is composed of disturbed and/or human-transported material. Parent material is alluvium. This soil is in hydrologic soil group C and has very low runoff. This soil is not subject to flooding or ponding. The depth to the water table is greater than 80 inches. The typical profile is composed of silty loam to a depth of 24 inches below the ground surface, silty clay loam from 24 to 51 inches, and silty clay from 51 to 79 inches (NRCS, 2015).

The San Andreas, Hayward, and Calaveras faults are active and can generate strong earthquakes. The San Andreas and Hayward faults are considered capable of causing earthquakes of magnitude 7.0 or greater on the Richter scale, and the Calaveras fault could generate a magnitude 6.8 event. Earthquakes of that size would produce strong ground shaking at the project area. The 1868 earthquake on the Hayward fault earthquake and the 1906 earthquake on the San Andreas fault caused lateral spreading, ground settlement and failure of stream banks along Coyote Creek in Milpitas (SCVWD, 2015). The project site is not within an Alquist-Priolo Fault Hazard Zone or landslide hazard area, but is located in a liquefaction hazard zone (State of California, 2004). The project area is not in a tsunami inundation area (California Emergency Management Agency, 2009).

2.4 Utilities

As Lower Penitencia Creek runs through an area of residential and industrial development, there are a number of utilities which run adjacent to or across the creek. The relocation, protection, or avoidance of these utilities could have a significant impact on work in or around the Project.

Existing PG&E underground gas lines include parallel 30-inch and 36-inch diameter gas mains which cross Reach 1 of Lower Penitencia Creek near McCarthy Boulevard and Dixon Landing Road. There is also a 10-inch underground nitrogen line within the vicinity of the two PG&E lines. This nitrogen gas pipeline is owned by Air Products and Chemicals, Inc. PG&E also operates overhead high-voltage power lines mounted on steel-lattice towers which are located on the east overbank in Reaches 3 and 4. Five power line towers are located in Reaches 3 and 4 on the outboard side of the east bank levee.

Both the California Circle and Milmont Drive bridges carry 12” water lines.

A detailed investigation of the locations of existing utilities is planned for the design phase.

2.5 Biological Resources

The project area is almost completely urbanized. The Lower Penitencia Creek channel is bordered to the north and east by commercial uses, Dixon Landing Road, and residential uses. The only substantial amount of undeveloped land in the project area occurs near the Coyote Creek confluence in Reach 1 and is separated from the creek by an existing earthen levee. Vegetation in this area includes pickleweed.

Federal-jurisdictional wetlands occur at and near the project area. The U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) classifies the creek bed in Reaches 1 through 4 as river channel, perennial, unconsolidated bottom, permanently flooded, excavated wetlands (R2UBHx). The retention pond operated by the City of Milpitas to the south of Reach 2 is classified as palustrine, unconsolidated bottom, permanently flooded, diked/impounded wetlands (PUBHh) (USFWS, 2015b).

The project area is not classified as critical habitat for federally threatened or endangered species (USFWS, 2015A). Coyote Creek is designated as critical habitat for the threatened steelhead (*Oncorhynchus mykiss*), but that critical habitat designation does not extend to Lower Penitencia Creek.

A search of the California Natural Diversity Database (CNDDB) (California Department of Fish and Wildlife, February 2016) showed seven sensitive species with the potential to occur in the project area: burrowing owl, California tiger salamander, longfin smelt, saltmarsh common yellowthroat, salt marsh harvest mouse, tricolored blackbird, and Western yellow-billed cuckoo. Of these, only San Francisco common yellowthroat, tricolored blackbird, and the Western pond turtle are likely to occur in the project area. The area is highly urbanized which presents a barrier to animals and birds that inhabit higher quality habitat areas located to the east, west, and north of the project site.

The burrowing owl was observed within 3 kilometers (km) of the project site, but is considered to be extirpated or possibly extirpated. They are considered extant within 3 km to the west of I-880; however, presence in the project area is not likely to occur due to the high level of disturbance and lack of open space.

California tiger salamander larvae were observed less than 3 km east of the project area in 1995 and are presumed extant at that location; however, I-680 acts as a barrier and there is no corridor to allow for movement into the project area.

Longfin smelt habitat includes California's bay, estuary, and coastal environments. Although longfin smelt could occur in Lower Penitencia Creek in winter and spring, water temperatures are typically too elevated for this fish and they are not expected to be abundant in the project area.

San Francisco common yellowthroat are presumed extant within 1 km of the project area and have potential to occur.

The nearest observation of salt marsh harvest mouse was in 1998 and this species considered extirpated.

Tricolored blackbird are presumed extant within 5 km of the project area and have potential to occur at the project area.

Western pond turtles did not have a recorded occurrence; however, they are presumed to be extant and have potential to occur in the project area.

Western yellow-billed cuckoo were last observed in the area in 1899 and are now considered extirpated, with no new observations in over 100 years (CNDDB, February 2016).

Potential impacts to native and non-native fish and nesting birds are also a concern (CDFW, 2014).

Table 2-2. CDFW Species of Special Concern that Could Occur in the Project Area, Based on CNDDB Research

Species	<1 km	<3 km	<5 km	<10 km	Status Federal/ State
Burrowing owl *(Athene cunicalaria)*		1999			-/SSC
California tiger salamander *(Ambystoma califoriense)*		1995			T/T
Longfin smelt (*Spirinchus thaleichthys)*				1995	-/T
San Francisco common yellowthroat *(Geothlypis trichas sinuosa)*	1998				-/SSC
Salt marsh harvest mouse *(Reithrodontomys raviventris)*	1998				E/E, FP
Tricolored backbird (*Agelaius tricolor)*			1971		-/SSC
Western pond turtle *(Actinemys marmorata)*	No observation, presence assumed				-/SSC
Western yellow-billed cuckoo *(Coccyzus americanus occidentalis)*	1899				T/E

Status Explanations:

Federal

E = listed as endangered under the federal Endangered Species Act
T = listed as threatened under the federal Endangered Species Act
– = no listing.

State

E = listed as endangered under the California Endangered Species Act
T = listed as threatened under the California Endangered Species Act
SSC = species of special concern in California
– = no listing.

The Streambed Alteration Agreement for the District's Lower Berryessa Creek Flood Protection Project required the District to implement the following measures to mitigate impacts of the Lower Berryessa Creek project:

- Construction dewatering in tidally-influenced areas is limited to June 15 through October 15 to avoid impacts to the longfin smelt.
- Qualified biologists must conduct surveys for nesting birds within 14 days prior to start of construction. Construction-free buffer zones (50 feet typical, and 300 feet for hawks, owls, herons, and egrets).
- Qualified biologists must conduct surveys for Pacific pond turtles within 48 hours prior to start of construction. If any Pacific pond turtles are found, they must be excluded from the construction area by CDFW-approved fencing.

Given the proximity of the Lower Berryessa Creek project, it is reasonable to assume that these same species concerns and measures would apply to the Lower Penitencia Creek project.

District staff conducted a preliminary investigation of riparian habitat in the project area in 2014. The investigation consisted of aerial photograph inspection with field verification. That survey identified about 0.6 acres of riparian habitat within the Lower Penitencia Creek channel (i.e., between the inner hinge points of the man-made levees on either side of the creek). Vegetation consisted predominantly of red willows and arroyo willows with smaller numbers of sagebrush, Italian buckthorn, acacia, pepper, ramnus, eucalyptus, and cottonwood. The center island in Reach 3 contained ten red willows, three arroyo willows, three sagebrushes, one fremont cottonwood, and one myopurum.

2.6 Hazardous Materials (Soil and Water)

Lower Penitencia Creek is located in an urbanized portion of the City of Milpitas. Industrial uses occur in the vicinity of Reaches 1 and 2, and commercial and residential uses predominate in the vicinity of Reaches 3 and 4.

On behalf of the District, Locus Technologies prepared a Phase I Hazardous Substance Liability Assessment (HSLA) report for a property that is planned to be acquired as part of the Project. This parcel (assessor's parcel number (APN) 022-30-041) is located southeast of the confluence of Lower Penitencia and Coyote Creeks and is owned by the City of Milpitas. The HSLA report was completed in November 2014 to support the potential future acquisition of the property. If acquired, the property would be used by the District to construct Lower Penitencia Creek channel improvements.

As the Phase I HSLA findings are viable for 6 months, the HSLA should be updated for any conditions that might have changed since the Locus HSLA. This updating of HSLA should be done within 6 months of the real estate transaction (escrow) so that no more updating is warranted.

No solid or hazardous waste was observed. Databases of hazardous materials were searched for sites within one mile of the subject property, and there were no sites which were determined to have a significant potential to impact the subject property.

Soil and groundwater within the subject property may be affected by historical use of herbicides and pesticides on the subject property, heavy vehicle traffic on adjacent roadways, and fill placed during construction of the I-880 interchange.

Locus Technology recommended that the District collect and analyze shallow soil and groundwater samples for the possible presence of herbicides, pesticides, asbestos, petroleum hydrocarbons, and metals. This soil testing should be conducted after the updating of the Phase I HSLA under so that if new concerns are identified they can be addressed.

Soil testing data and any other concerns identified above should be included in the Special Provisions of the construction contract. If possible, conduct the soil sampling and testing within 6 months of start date of construction and excavation on the subject parcel. If excavated soils require a landfill disposal, the landfill would require test results current within 6 months. If soil tests exceed regulatory action levels, such areas including depths of contamination should be depicted on construction drawings so contractors can bid appropriately.

2.7 Related/Nearby Projects

This section briefly describes past and present studies, projects, and programs that are relevant to the project. As shown in Figure 1-1, the District has two capital flood protection projects located immediately east of Lower Penitencia Creek, the Lower and Upper Berryessa Creek Projects. Completion of improvements along the Lower and Upper Berryessa Creek Projects will increase the 1 percent design flow for the Lower Penitencia Creek Improvement Project. Lower Penitencia Creek, in its existing condition, lacks capacity to convey the increased 1 percent design flow.

Construction of the Lower Berryessa Creek Project Phase 1 (Lower Penitencia Creek to downstream of Abel Street) began in summer 2015 and is scheduled for completion in 2017. Lower Berryessa Creek Phase 2 consists of two parts: (1) Lower Berryessa Creek (downstream of Abel Street to Calaveras Boulevard) will begin construction in summer 2016 and is scheduled to be completed in 2017, and (2) Calera Creek (Union Pacific Railroad to an existing drop structure approximately 3,000 feet upstream of the confluence with Berryessa Creek) will be constructed by 2018. Construction of the Upper Berryessa Creek Project (Calaveras Boulevard to I-680) is also scheduled for completion in 2017. Lower Penitencia Creek construction must be completed within the same time frame as the Lower and Upper Berryessa Creek Projects to avoid inducing downstream flooding. Lower Penitencia Creek construction is also necessary to ensure its FEMA certified east levee does not become de-certified resulting in a portion of the community being placed back into FEMA's special flood hazard area.

The Lower Penitencia Creek Project team will continue to coordinate with the Lower and Upper Berryessa Creek project teams to ensure that the project, designs, implementation, and schedules are compatible.

CHAPTER 3. PROBLEM DEFINITION

This section describes the evaluation and analysis of the hydrologic and hydraulic conditions of the project area. The problems identified in the Project area include conveying a substantially increased 100-year flowrate, accommodating tidal sediment deposition, anticipating sea level rise, and having limited right-of-way available for improvements.

3.1 Increased Flow from Upstream Capital Projects

During the process of recertifying the levees on Lower Penitencia Creek, the District found that Lower Penitencia Creek may not have the capacity to convey the 1 percent flow when the Lower and Upper Berryessa Creek flood improvement projects are completed. The Coyote Watershed Division initiated the Lower Penitencia Creek capital project in October 2008.

In its current condition, Lower Penitencia Creek has the capacity to accommodate the existing 1 percent flow without overtopping levees. However, planned upstream capital improvements to Lower Berryessa Creek (Lower Penitencia Creek to Calaveras Boulevard), Upper Berryessa Creek (Calaveras Boulevard to I-680), Lower Calera Creek, and Tularcitos Creek will increase the 1 percent flowrate, exceeding the existing conveyance capacity of the Lower Penitencia Creek.

With the completion of the Lower and Upper Berryessa Creek flood protection projects as described above, the future 1 percent design flowrate will increase from 4,830 cfs to 6,810 cfs at the downstream limit of the Project.

In addition, future improvements on Upper Berryessa Creek (I-680 to Old Piedmont Road) and two of its tributaries, Los Coches Creek and Piedmont Creek, would increase the future flowrate at the downstream limit of the Project to 8,720 cfs. The Project is being designed to accommodate this flow case, 8,720 cfs.

3.2 Sediment Deposition and Tidal Influence

Lower Penitencia Creek is a tidally influenced tributary to Coyote Creek located near South San Francisco Bay, and receives incoming sediment with semi-diurnal tidal fluctuations. In 2015, the District conducted an analysis of the tidal range, making observations of water levels and vegetation, sampling sediment in the channel, and analyzing the particle size distribution. The bed material sample in the creek at California Circle was observed to be 97% silt and clay and 3% sand. This indicated tidal sediment deposition.

By contrast, at Marylinn Drive (about 0.5 mile upstream of the project area), silt and clay content drops to 34% as a result of reduced tidal influence. The entire project area is subject to tidal influence, which results in deposition of large amounts of fine clays and silts during periods of stagnant flow. In the past, sediment has been removed by the District as part of watershed maintenance activities. It is a goal of this project to design flood protection improvements that allow for the tidal sediment load to remain.

Table 3-1 lists the tidal datums for the NOAA tide station at Coyote Creek (USACE, 2015).

Table 3-1. Coyote Creek Tidal Datums

TIDE LEVEL	ELEVATION (North American Vertical Datum 1988)
Mean Lower Low Water	-1.35 feet
Mean Tide Level	+3.48 feet
Mean Higher High Water	+7.64 feet

3.3 Boundary Conditions and Sea Level Rise

Lower Penitencia Creek's 1 percent boundary water surface elevation must conform to the 1 percent water surface elevations at its confluences with Coyote Creek and Berryessa Creek. The design water surface elevation at the Berryessa Creek confluence point must not be exceeded.

FEMA requires that for riverine flooding analyses, "When the downstream boundary of a modeled stream is within a coastal tidal reach, the tidal boundary of the model is taken as equal to the Mean Higher High Water (MHHW) level of the nearby tide station."

Consistent with District practice, two flow combinations were analyzed, which are more conservative than FEMA requirements:

- 100-year flow and 10-year tide
- 10-year flow and 100-year tide

It was determined that Case #1 is the controlling case.

The future sea level rise scenarios assume a 50-year period of analysis through Year-2070. A total of six starting water surface boundary conditions were analyzed: MHHW or the 10-year tide, combined with low (0.51 feet), intermediate (1.01 feet), or high (2.59 feet) sea level rise (USACE, 2015). These sea level rise estimates were based on the Corps South San Francisco Bay Shoreline Phase 1 Study.

The following are the starting water surface elevations that are recommended for the two projects:

- Lower Penitencia Creek at Coyote Creek: 14.0 feet NAVD88
- Lower Berryessa Creek at Lower Penitencia Creek: 21.1 feet NAVD88

All six starting water surface boundary conditions that were analyzed will be accommodated by the design criteria established for the design for Lower Berryessa Creek.

3.4 Right of Way

Lower Penitencia Creek exists in a highly urbanized area. Areas on either side of the creek are nearly completely built up with homes, businesses, and roads. The unavailable right of way and cost of real estate for the area make it challenging to expand Lower Penitencia Creek outside of its existing footprint and has constrained what flood protection improvements can be considered.

From Coyote Creek to Interstate 880, the District has fee title and easement. The south levee is owned by the City of Milpitas. Under Interstate 880, Caltrans owns the creek and the District has an easement. Between Interstate 880 and California Circle, the south levee is owned by a private party and the north levee is owned by the City of Milpitas; the District has an easement on both parcels. Between California Circle and Milmont Drive, the District owns the main channel and east levee, but both the secondary channel and west levee are in private ownership and the District has easements on them. From Milmont Drive to the Berryessa Creek confluence, the District owns the channel, east levee, and east top-of-bank landscaping strip. The west levee is privately owned and the District has an easement.

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CHAPTER 4. PROJECT OUTREACH

4.1 Objectives and Benefits of Outreach

One of the most important aspects of the planning process is the identification and participation of external parties with an interest in the proposed project. Interested parties include individuals, agencies, and organizations which may affect or be affected by the Lower Penitencia Creek Improvements Project. These entities may have a vested interest in the objectives, activities, implementation, and outcomes of the project. The success of the project depends in part on effective collaboration with interested parties. The benefits of outreach to interested parties include:

- Facilitates better decisions and better implementation of decisions;
- Engenders buy-in and support for the project;
- Promotes ownership of the project by interested parties;
- Guards against the project becoming too inwardly focused;
- Aids decentralized decision making; and
- Helps to identify issues not addressed by the project staff.

The majority of the stakeholder(s) will be those directly affected by the project and those interested in possible impacts to the site from an environmental or regulatory nature. Throughout the planning process, outreach activities have been carried out to inform the public of project progress and solicit public feedback. The Project's webpage on the District's website has been updated as the Project planning has progressed.

4.2 Outreach Efforts to Date

The project team has worked with internal and external stakeholders on this project. One key stakeholder is the City of Milpitas. The District met with the City of Milpitas staff from the Planning and Public Works Departments at Milpitas City Hall on February 21, 2014. At that meeting the District provided an overview of the project to City of Milpitas staff. Additional items discussed included the potential availability of City of Milpitas-owned real property for project use, project objectives for reducing flood risks, major developments planned in the project vicinity, inclusion of public-use trails in project design, CEQA compliance, and community concerns.

The District included Senior Planner Scott Ruhland from the City of Milpitas on the Consultant Review Board (CRB) for the environmental consulting agreement. Mr. Ruhland actively participated in the evaluation of written proposals and the oral presentation portion of the consultant selection process in 2014.

To support preparation of the feasible alternatives report, the District hosted a community information meeting for the project at Milpitas City Hall on June 5, 2014. The meeting was well attended by City of Milpitas representatives and members of the public. The result of the meeting concluded with the residents agreeing that there was a need for work associated with the Lower Penitencia Creek and there would be benefits to the project when the work is completed in 2018. The District posted official answers to questions received at the public information meeting to the District's website.

On June 11, 2015, the District submitted the Notice of Preparation (NOP) for the Project Environmental Impact Report (EIR) to the State Clearinghouse (SCH) (a.k.a. Office of Planning and Research). The NOP stated the District's intent to prepare an EIR for the project, described the project, and requested input from interested parties on the data sources and environmental concerns. The NOP was distributed for review and comment to numerous federal and state agencies; departmental and public services agencies within Santa Clara County, and the City of Milpitas. Additionally, the NOP was posted to the District's website. The NOP response period ended on July 10, 2015, and the District received responses from the California Department of Transportation (Caltrans) and the San Francisco Bay Regional Water Quality Control Board (RWQCB). The EIR will address the concerns raised by Caltrans and RWQCB.

4.3 Ongoing and Future Outreach

During the project design phase, the project team will continue to work with internal and external stakeholders to develop relationships and lines of communication that will further project development and implementation. Key internal participants will be the Design and Construction Unit Manager, Project Manager, Environmental Planner, Public Information Officer, and Community Projects Review staff.

During the design phase, the project team will prepare an Environmental Impact Report (EIR) complying with requirements of the California Environmental Quality Act (CEQA). The project team will use the CEQA process as a primary tool for engaging and informing interested parties, including City of Milpitas officials, local residents, and regulatory agencies.

During the design phase, the District will continue the outreach efforts by engaging stakeholders, including landowners, utility service providers, area residents, and regulatory agencies as necessary to design and permit the project. Information on the project will be provided to stakeholders:

- To acquire real property rights needed for project construction;
- To arrange necessary relocation of utility lines;
- To provide area residents of project progress; and
- To obtain required project permits.

These efforts may include public information meetings, multi-agency meetings with regulators, and regular updates of project status on the District website.

During the construction phase, District staff will be available to respond to inquiries from stakeholders about project implementation. The District will continue to update the project page on the District's website to keep interested parties informed of project progress.

CHAPTER 5. FORMULATION AND EVALUATION OF ALTERNATIVES

The District's planning process generally has three stages: development of conceptual alternatives, development of feasible alternatives, and finally the development of a staff-recommended project. This chapter provides details on the conceptual and feasible alternatives developed in these processes and documents the evaluation used to select the staff-recommended project.

5.1 Conceptual Alternatives

During the conceptual alternatives stage, numerous approaches to meet the project objectives were identified. Each of these approaches is referred to as a *Conceptual Project Element* (CPE). The following CPEs were developed during the conceptual alternatives stage and then were refined during the feasible alternatives stage.

1. No Project

Under this CPE, the channels would remain in their existing conditions. Flood flows would overtop channel banks and inundate adjacent properties. Current maintenance activities to remove sediment and manage vegetation would continue.

2. Levee

This CPE would provide flood protection by creating a new levee or raising an existing levee, thereby increasing the overall channel capacity. Levees would be designed with 2H:1V side slopes and a minimum top width of 18 feet.

3. Vegetated Bench

This CPE would widen the channel area, adding a bench above the channel bottom that would be planted with wetland vegetation, providing more channel conveyance and also more habitat.

4. Floodwall—Constructed on Existing Levee

This CPE would provide flood protection by creating a vertical concrete structure that would contain flow within the channel, thereby increasing overall channel capacity. Floodwalls would be constructed on the outboard side of the levee and where possible, would be placed at a minimum distance of 18 feet from the inboard top of bank to provide adequate access for maintenance activities.

5. Floodwall—Remove Existing Levee

This CPE would provide flood protection by creating a vertical concrete structure that would contain flow within the channel, thereby increasing overall channel capacity. A portion of the existing levee would be removed, and a floodwall would be constructed in its place, on the outboard side of the channel and where possible, would be placed at a minimum distance of 18 feet from the inboard top of bank to provide adequate access for

maintenance activities. The base of the new floodwall would be at approximately the same elevation as the maintenance road on the opposite bank.

6. Bridge Raising

This CPE would provide flood protection by increasing the available flow capacity at a bridge crossing by replacing the existing bridge with a new bridge that has a larger opening, due to raising of the bridge and widening of the bridge cells.

7. Widen Bridge Opening

This CPE would provide flood protection by increasing the available flow capacity at a bridge crossing by replacing the existing bridge with a new bridge that has a wider open conveyance area below the bridge.

8. Concrete-Lined Channel

This CPE would provide flood protection by excavating portions of the existing channel to create a trapezoidal concrete cross-section. The channel would be lined with concrete, which would reduce the channel roughness, allowing more flow to be conveyed.

9. Off-Stream Detention Area

This CPE would provide flood protection by temporarily diverting high flows during a flood event into an off-stream detention area. After the peak of the storm passed, the flows would be released to the creek.

10. Bypass Channel

This CPE would provide flood protection by constructing an underground bypass culvert that would start at the confluence of Lower Penitencia and Lower Berryessa Creeks and flow westward to connect with Coyote Creek.

11. Annual Sediment Removal

This CPE would provide flood protection by increasing the frequency of sediment removal activities in the channel to every year. Sediment removal would not be allowed to be delayed or deferred to future years but must occur on an annual basis.

Most of the conceptual alternatives were composed of several CPEs used in combination to meet the Project objectives.

Ten alternatives, including the No Project alternative, were developed and analyzed in the conceptual alternative stage of the Project (Table 5-1).

During the conceptual alternatives development stage, removal of the Reach 3 center island was explored. However, this idea was not pursued further due to concerns about the impacts of removing existing mature trees, and the possibility of tules establishing in the former island area. The tule growth could become a flow barrier and a maintenance burden.

Removal of the trees on the Reach 3 center island (while leaving the center island intact) was contemplated to reduce the potential for trees to fall into the creek and become flow obstructions at the California Circle bridge. However, it was decided to leave these trees in place, as they contribute to habitat complexity and promote biodiversity.

Table 5-1. Conceptual Alternatives

Alternative No.	CPE / Alternative	Levee	Vegetated Bench	Floodwall—Constructed on Existing Levee	Floodwall—Remove Existing Levee	Bridge Raising	Widen Bridge Opening	Concrete-Lined Channel	Off-Stream Detention Area	Bypass Channel	Annual Sediment Removal
	No Project										
1	Levees, Floodwalls, Raise and Widen Opening of One Bridge	X	X	X		X	X				X
2	Levees, Floodwalls, Widen Opening of Two Bridges	X	X	X			X				
3	Levees, Setback Floodwalls, Raise and Widen Opening of One Bridge, Raise One Bridge	X	X		X	X	X				
4	Levees, Setback Floodwalls, Raise and Widen Opening of One Bridge, Raise One Bridge	X	X		X	X	X				
5	Levees, Floodwalls, Setback Floodwalls, Raise and Widen Opening of One Bridge, Raise One Bridge	X	X		X	X	X				
6	Concrete-Lined Trapezoidal Channel	X		X			X	X			X
7	Off-Stream Detention Basin								X		
8	Bypass Channel to Coyote Creek									X	
9	Annual Sediment Removal										X

5.2 Conceptual Alternatives Determined Not to Be Feasible

The ten conceptual alternatives were evaluated and it was determined that five alternatives were feasible, including the No Project alternative. Alternatives 3, 5, 7, 8, and 9 were determined not to be feasible, and the basis for these determinations is described below. Cost, logistical issues, and/or the ability to meet the project objectives were the factors used to determine feasibility.

Conceptual Alternative 3, Levees, Floodwalls, Raise and Widen One Bridge, Raise One Bridge. The difference between Alternative 3 and 4 is that in Alternative 3, the Milmont Drive bridge would be raised only, while in Alternative 4, the Milmont Drive bridge would be both raised and widened. It was decided that Alternative 4 was the better option to move forward to the feasible alternatives phase.

Conceptual Alternative 5, Levees, Floodwalls, Setback Floodwalls, Raise and Widen One Bridge, Raise One Bridge. The difference between Alternatives 4 and 5 is the location of the setback floodwalls along the Reach 3 west bank. In Alternative 5, the setback floodwalls would be located at the outboard toe of the existing levee. Alternative 5 was eliminated because the location of the setback floodwalls would not leave adequate room for the floodwall footings.

Conceptual Alternative 7, Off-Stream Detention Basin. Given a peak flow of 8,400 cfs on Lower Penitencia Creek at the Lower Berryessa Creek confluence, approximately 800 acre-feet of flows would need to be detained. Assuming a 10–15-foot depth, acquisition of 50–80 acres of land near the creek would be needed for the detention basin. Construction of a weir would be necessary.

The land near the creek is highly urbanized, and at current real estate prices of approximately $2 million per acre, the cost just to acquire this land (without factoring in demolition and construction) would be $100–160 million. A detention basin of the required size would require the demolition of structures and relocation of residents and/or businesses. The economic and social impacts would be considerable and likely would be unacceptable to the local the community. The detention basin would be dry much of the time and could be used for beneficial recreational and ecological purposes. However, it is not a feasible solution to provide flood protection for the Project reach.

Conceptual Alternative 8, Bypass Channel to Coyote Creek. The bypass would need to cross McCarthy Ranch Boulevard, I-880, and Cadillac Court, and would cross four parcels (all privately owned), three of which are developed with commercial buildings and parking lots. The total length of the bypass would be about 2,500 ft. In addition, the bypass would need to breach the Coyote Creek and Lower Penitencia Creek levees.

This alternative would require easements to tunnel below existing residential and industrial developments, as well as I-880. Much of the route would be within parking areas associated with the commercial properties located between I-880 and Lower Penitencia Creek.

This alternative could also have adverse thermal impacts to fish habitat as water discharged from a bypass to Coyote Creek (designated as critical habitat for the California Central Coast steelhead, listed as threatened under the federal Endangered Species Act) could have elevated temperature. .

Conceptual Alternative 9, Annual Sediment Removal. Annual sediment removal will not provide the needed capacity, and is estimated to cost $850,000 each time sediment removal is conducted. Over fifty (50) years, with sediment removal conducted every two years, the total lifetime maintenance cost would be over $20 million. In addition, with regular sediment removal, only poor quality habitat would develop.

Since annual sediment removal does not meet the Project objective of providing the necessary flow conveyance capacity, it was not determined to be a feasible solution.

5.3 Feasible Alternatives Description

The purpose of this section is to provide descriptions of each of the feasible alternatives. Figures of these alternatives are contained in Appendix A.

5.3.1 No Project

Alternative Description

Under the No Project alternative, no new elements would be implemented in the project area. Flood flows would overtop channel banks and inundate adjacent properties, resulting in flood-related damages to residences and businesses. Current maintenance activities such as sediment removal and vegetation maintenance would continue. Although this alternative does not meet the Project objectives, it is included here because CEQA requires that the No Project alternative be analyzed.

5.3.2 Alternative 1 – Floodwalls with Raised and Widened Opening for California Circle Bridge

Alternative Description

This alternative combines raising the bridge, widening the opening, and constructing floodwalls, levees, and vegetation bench elements. This would increase the capacity of all project reaches to convey the design flow and provide channel stability.

Operation and Maintenance

New maintenance activity due to the construction of Alternative 1 would be annual sediment removal and vegetation management along the channel in Reaches 2 and 4; graffiti removal would also be anticipated due to the installation of new floodwalls. Other maintenance activities, such as trash and debris removal, would be the same as under existing condition.

Land Ownership/Access

Raising and widening the opening of the California Circle bridge on its east side would require coordination with Caltrans and permits from the City of Milpitas. All other improvements would occur within existing District easement or fee title.

Cost Estimate

Construction:	$17,370,000
Land Acquisition:	--
50-Year Maintenance:	$21,730,000
Total Lifetime Cost:	$39,100,000

5.3.3 Alternative 2 – Expanded Reach 1 Floodplain, Floodwalls, Widened Openings for California Circle and Milmont Drive Bridges

Alternative Description

This alternative combines floodwalls, levees, vegetated benches, and widening the bridge opening of the California Circle and Milmont Drive bridges. This would increase the capacity of all the project reaches to convey the design flow, provide channel stability, and improve water quality and channel habitat.

Operation and Maintenance

New maintenance activity due to the construction of Alternative 2 would be limited to an anticipated increase in graffiti removal due to the installation of new floodwalls. Other maintenance activities under Alternative 2, such as trash and debris removal and mowing the channel banks would be the same as under the existing condition. This alternative would eliminate the need for regular sediment removal.

Land Ownership/Access

Replacing the two bridges would require coordination with Caltrans and permits from the City of Milpitas. In this alternative, between the Coyote Creek confluence and I-880, reconstruction of the south levee by construction of a 50-foot-wide vegetated bench would require right-of-way acquisition from the City of Milpitas. All other works would occur within the District easement or fee title.

Cost Estimate

Construction:	$20,780,000
Land Acquisition:	$ 70,000[2]
50-Year Maintenance:	$ 5,030,000
Total Lifetime Cost:	$25,880,000

5.3.4 Alternative 4 – Expanded Reach 1 Floodplain, Floodwalls, Reach 3 West Levee Replaced by Floodwall, Raised and Widened Openings for California Circle and Milmont Drive Bridges

Alternative Description

This alternative's elements are similar to Alternative 2, with the addition of a significantly taller floodwall and the vegetated bench on the west side of Reach 3. This alternative combines raising and widening the opening of the California Circle bridge, raising the Milmont Drive bridge, and constructing floodwalls, levees, and vegetated bench elements. This would increase the capacity of all project reaches to convey the design flow, provide channel stability, and improve water quality and channel habitat.

[2] Based on unit cost provided by the Real Estate Services Unit for Agriculture/Parks/Recreation. Parcel area is 1.43 acres. This is a District cost estimate and will need to be negotiated with the City of Milpitas.

Operation & Maintenance

New maintenance activity due to the construction of Alternative 4 would be limited to an anticipated increase in graffiti removal due to the installation of new floodwalls. Under Alternative 4, maintenance activities such as trash and debris removal and mowing the channel banks would be the same as under the existing condition. This alternative would eliminate the need for regular sediment removal.

Land Ownership/Access

Replacing the California Circle and Milmont Drive bridges would require coordination with Caltrans and permits from the City of Milpitas. In this alternative, between the Coyote Creek confluence and I-880, relocating the south levee by constructing a 50-foot-wide vegetated bench would require right-of-way acquisition from the City of Milpitas. All other work would occur within the District easement or fee title.

Cost Estimate

Construction:	$29,380,000
Land Acquisition:	$ 70,000
50-Year Maintenance:	$ 5,230,000
Total Lifetime Cost:	$34,680,000

5.3.5 Alternative 6 – Concrete-lined Channel, Floodwalls, Widened Opening for California Circle Bridge

Alternative Description

This alternative combines levees, floodwalls, widening the opening of the California Circle bridge and the channel at this location, island removal in Reach 3, and considerable concrete bed and bank linings along the entire channel (trapezoidal concrete channel with 1:1 side slopes), except for Reach 1, which would retain earthen bed and banks. This would increase the capacity of all the project reaches to convey the design flow and provide channel stability.

Operation & Maintenance

New maintenance activities due to the construction of Alternative 6 would include an anticipated significant increase in graffiti removal due to the installation of new floodwalls and concrete channel lining. Annual sediment removal would be required in Reaches 2, 3, and 4. Under Alternative 6, maintenance activities such as trash and debris removal would be the same as under the existing condition.

Land Ownership/Access

Widening the opening of the California Circle bridge and the channel at this location would require coordination with Caltrans and encroachment permits from the City of Milpitas. All other works would occur within the District easement or fee title.

Cost Estimate

Construction:	$37,310,000
Land Acquisition:	--
50-Year Maintenance:	$27,150,000
Total Lifetime Cost:	$64,460,000

5.4 Refined Alternative Details

After the feasible alternatives were defined, the bridge elements of the alternatives were modified. It was determined through an internal structural engineering evaluation that raising the entire structure of the bridges was not necessary. Additional clearance under the bridges could be accomplished by replacing the existing clear span bridges with bridges with thinner decks on piers. This would maintain the existing top of road elevations.

The cost estimates were updated to reflect the new bridge configurations and more current construction costs. Inspection and mitigation costs were also added.

5.4.1 Refined Alternative 1 - Floodwalls with Raised Soffit and Widened Opening for California Circle Bridge

The conceptual approach to improving the California Circle Bridge was changed from raising the bridge and widening the opening to only widening the bridge opening by a bridge replacement that maintains the existing top of road elevation and raises the bridge soffit. A thinner bridge deck can be accomplished by using different bridge construction materials and adding a pier wall at the midpoint of the bridge.

Along Lower Penitencia Creek, average floodwall/levee heights would range from 3.5 to 6.0 feet; other proposed features are also described below:

- Reach 1
    - South bank: levee would be raised 3.5 feet
- Reach 2
    - South bank: floodwall (6 feet high)
    - North bank: 40-foot-wide vegetated bench
- California Circle bridge opening would be widened by 25 feet (from 97 to 122 feet), existing soffit would be raised. Vertical wall supporting bridge would be built on north bank, replacing the existing sloped concrete embankment. Channel bottom at north toe would be widened to 40 feet.
- Reach 3
    - Vertical wall under California Circle would be extended on the north side for 170 feet in the upstream direction.
    - Both banks: floodwalls (4 feet high)

- Reach 4

    - Both banks: floodwalls (5 feet high)

    Details and figures for this alternative are provided in Appendix A.

Revised cost estimate

Construction:	$16,910,000
Land Acquisition:	--
50-Year Maintenance:	$21,730,000
Total Lifetime Cost:	$38,640,000

The detailed cost estimate can be found in Appendix B.

5.4.2 Refined Alternative 2A - Expanded Reach 1 Floodplain, Floodwalls, Raised Soffits and Widened Openings for California Circle and Milmont Drive Bridges

During the refined alternative analysis, Alternative 2 was renamed Alternative 2A because Alternative 2 required annual sediment removal in Reaches 3 and 4, but additional analysis determined that annual sediment removal was not required, so this lower-maintenance version of Alternative 2 was named Alternative 2A.

California Circle and Milmont Drive were modified from widening the bridge opening to widening the bridge opening by bridge replacements that maintain the existing top of road elevation and raise the soffit. A thinner bridge deck can be accomplished by using different bridge materials and adding a pier wall at the midpoint of each bridge.

Along Lower Penitencia Creek, average floodwall/levee heights would range from 4 to 5.5 feet; other proposed features are also described below:

- Reach 1

    - South bank: levee would be relocated 50 feet southward and raised 4 feet, creating area for a vegetated bench

- Reach 2

    - South bank: floodwall (5.5 feet high)
    - North bank: 40-foot-wide vegetated bench

- California Circle bridge opening and the channel beneath would be widened by 25 feet (from 97 to 122 feet), and the existing soffit elevation would be raised. Existing sloped concrete embankment supporting bridge on north side would be replaced by vertical wall. Channel bottom at north toe would be widened by 40 feet. Bridge structure would include a pier wall in the center of the channel.

- Reach 3

    - Vertical wall under California Circle would be extended on the north side for 170 feet in the upstream direction.

- o Both banks: floodwalls (4 feet high)

- Milmont Drive bridge opening would be widened by 35 feet (from 97 to 132 feet), existing soffit elevation would be raised. Channel bottom at east toe would be widened to 25 feet and raised to create vegetated bench. Bridge structure would include a pier wall in the center of the channel.

- Reach 4

  - o Both banks: floodwalls (5 feet high)

Details for this alternative are provided in Appendix A.

Revised cost estimate

Construction:	$21,160,000
Land Acquisition:	$ 70,000
50-Year Maintenance:	$ 5,030,000
Total Lifetime Cost:	$26,260,000

The detailed cost estimate can be found in Appendix B.

5.4.3 Refined Alternative 4 - Expanded Reach 1 Floodplain, Floodwalls, Reach 3 West Levee Replaced by Floodwall, Raised Soffits and Widened Openings for California Circle and Milmont Drive Bridges

California Circle bridge opening would be widened, the soffit elevation would be raised, and channel would be widened at this location. Milmont Drive modified from being raised to only widening the bridge opening by a bridge replacement that maintains the existing top of road elevation yet raises the soffit elevation. The channel would be widened at this location by 25 feet. A thinner bridge deck can be accomplished by replacing the existing clear span bridges with thinner decks supported by a pier wall below the midpoint of the bridge at each location.

Along Lower Penitencia Creek, average floodwall/levee heights range from 3 to 16 feet in the following locations:

- Reach 1

  - o South bank: levee would be relocated 50 feet westward and raised 3 feet, creating area for a vegetated bench

- Reach 2

  - o South bank: floodwall (5 feet high)
  - o North bank: 40-foot-wide vegetated bench

- California Circle bridge opening and channel beneath would be widened by 25 feet (from 97 to 122 feet), existing soffit elevation would be raised. Vertical wall supporting bridge would be built on north bank, replacing existing sloped concrete embankment. Channel bottom at north toe would be widened to 40 feet. Bridge structure includes one splitter wall/piers in center of channel.

- Reach 3
    - Vertical wall under California Circle would be extended on the north side for 170 feet in the upstream direction.
    - West bank: floodwall (16 feet high) and vegetated bench (25–45 feet wide)
    - East bank: floodwall (3.5 feet high)
- Milmont Drive bridge opening and channel beneath would be widened by 35 feet (from 97 to 132 feet), existing soffit elevation would be raised. Channel bottom at east toe would be widened by 25 feet and raised to create vegetated bench. Bridge structure would include a pier wall in the center of the channel.
- Reach 4, both banks: floodwalls (5 feet high)

Details for this alternative are provided in Appendix A.

Revised cost estimate

Construction:	$34,210,000
Land Acquisition:	$ 70,000
50-Year Maintenance:	$ 5,230,000
Total Lifetime Cost:	$39,510,000

The detailed cost estimate can be found in Appendix B.

5.4.4 Refined Alternative 6 - Concrete Channel, Floodwalls, Raised Soffit and Widening Opening for California Circle Bridge

Reaches 2, 3, and 4 would be a trapezoidal concrete channel. Along Lower Penitencia Creek, average floodwall/levee heights would range from 3 to 5.5 feet in the following locations:

- Reach 1
    - South bank: levee would be raised 4 feet
- Reach 2
    - South bank: floodwall (5.5 feet high)
- California Circle bridge opening would be widened by 25 feet (from 97 to 122 feet), existing soffit elevation would be raised
- Reach 3
    - Vertical wall under California Circle would be extended on the north side for 170 feet in upstream direction
    - Center island would be removed to form trapezoidal cross-section, channel would be lined with concrete

- o Both banks: floodwall (4 feet high)

- Reach 4
  - o Both banks: floodwalls (3 feet high)

Details for this alternative are provided in Appendix A.

Revised cost estimate

Construction:	$55,010,000
Land Acquisition:	--
50-Year Maintenance:	$27,150,000
Total Lifetime Cost:	$82,160,000

The detailed cost estimate can be found in Appendix B.

Table 5-2. Refined Feasible Alternatives Summary

		Alt 1	Alt 2A	Alt 4	Alt 6
Channel Type		Earth	Earth	Earth	R1: Earth R2, R3, & R4: Concrete
Floodwalls		4 - 6 ft high	4 - 5.5 ft high	3.5 - 16 ft high	4 - 5.5 ft high
Levees		3.5 ft high	4 ft high	3 ft high	4 ft high
Vegetated Bench		R2	R1, R2	R1, R2, & R3	--
R3 Island		--	--	--	Remove Island
Bridges	California Circle	Raise existing soffit & widen bridge	Raise existing soffit & widen bridge	Raise existing soffit & widen bridge	Raise existing soffit & widen bridge
	Milmont Drive	No change, but U/S pressure flow	Raise existing soffit & widen bridge	Raise existing soffit & widen bridge	--
Water Surface Elevation at Lower Berryessa Creek confluence (ft. NAVD88)		21.01	20.59	20.28	18.7
Land Acquisition	Parcels	0	1	1	0
New Operations and Maintenance Activities		Annual sediment removal in Reaches 2 and 4	Reduced sediment removal in channel	Reduced sediment removal in channel	Annual sediment removal in Reaches 2, 3, and 4
					Reduced vegetation management in channel
		Additional graffiti removal	Additional graffiti removal	Additional graffiti removal	Additional graffiti removal
O&M Cost	Annually	$380,000	$87,000	$91,000	$470,000
	Over 50 yrs	$21.7 million	$5.0 million	$5.2 million	$27.2 million
Construction Cost		$16.9 million	$21.2 million	$34.2 million	$55.0 million
Land Acquisition			$70,000	$70,000	
Total Lifetime Cost		$38.6 million	$26.3 million	$39.5 million	$82.2 million

Notes:
- Lower Penitencia Creek's 1 percent water surface elevation at the Lower Berryessa Creek confluence point should not exceed 21.1 feet NAVD88.
- 170 feet upstream of California Circle in Reach 3 there will be 15 feet tall floodwalls in all alternatives.

5.5 Feasible Alternatives Analysis (NFP)

The purpose of this section is to document the process used to evaluate the feasible alternatives.

5.5.1 Natural Flood Protection Evaluation Process

The District Board of Directors (Board) has adopted Ends Policy E-3 which states, “There is a healthy and safe environment for residents, businesses and visitors, as well as for future generations.” As part of this policy, the Board has adopted a goal that states that “natural flood protection” is to be the method the District uses to provide flood protection. The CEO has interpreted the policy and goal as documented below.

The following objectives are balanced when selecting the preferred alternative to modify or maintain creeks to provide flood protection:

1. Homes, schools, businesses, and transportation networks are protected from flooding and erosion.
2. Projects are integrated within the watershed as a whole.
3. Ecological functions and processes are supported.
4. Geomorphic stream functions and processes are integrated into project design.
5. Maintenance requirements are minimized.
6. The quality and availability of water are protected for ecological and water supply functions.
7. Cooperation with local agencies achieves mutually beneficial goals.
8. Community benefits beyond flood protection are realized.
9. Life-cycle costs are minimized.
10. Environmental impacts are avoided, minimized, or mitigated.

To comply with the ends policy and CEO interpretation, the Natural Flood Protection (NFP) evaluation process (QEMS work instruction WW75125—Guidance on Alternative Evaluation and Selection for Natural Flood Protection Projects) was developed to rate and compare flood protection project alternatives. Various criteria were developed to help rate each objective. The objectives and corresponding criteria are listed below.

Objective 1: Homes, Schools, Businesses and Transportation Networks Are Protected From Flooding and Erosion

Criterion C1.1: Safety—Protection of public safety if conditions exceed design assumptions

Criterion C1.2: **Economic protection—Protection from damage due to floodwater, erosion or sediment for homes, schools, businesses, transportation systems and other infrastructure**

Criterion C1.3: Durability—Future District effort required to maintain design level of protection

Criterion C1.4: Resiliency—Adaptability to future changes external to District activities

Criterion C1.5: Local drainage—Support of local storm drain systems

Criterion C1.6: Time to implementation—Practicality of implementation accounting for logistical, negotiation and cost issues

Objective 2: Integrate Within the Context of the Watershed

Criterion C2.1: Meets local watershed goals—Ability to meet watershed goals as defined in a process that examines the watershed as a whole and accounts for opportunities and constraints specific to the project area. Published documents such as the City of Milpitas General Plan and the San Francisco Bay Basin Plan are consulted for opportunities and constraints specific to the project area.

Objective 3: Support Ecological Functions and Processes

Criterion C3.1: Meets local habitat goals—Ability to meet habitat goals as defined from examining the watershed as a whole and accounting for opportunities and constraints specific to the project area

Criterion C3.2: Quality of habitat—Quality and variety of habitat provided by the alternative

Criterion C3.3: Sustainability of habitat—Intensity of future human intervention required to maintain the target habitat quality; opportunity for habitat to self-adjust appropriately to future change

Criterion C3.4: Connectivity of habitat—Integration of habitat elements into surrounding habitat landscape and within project area

Objective 4: Integrate Physical Geomorphic Stream Functions and Processes

Criterion C4.1: Floodplain—Inclusion of an appropriately-sized overflow area within the flood conveyance corridor that effectively conveys high flows and dissipates erosive energy (“multi-stage” channel)

Criterion C4.2: Active channel—Appropriateness of size and configuration of the “active channel” relative to watershed inputs (water and sediment) and reach characteristics

Criterion C4.3: Stable side slopes—Stability of channel side slopes using geotechnical or biotechnical methods

Criterion C4.4 Upstream/downstream transitions—Stability of channel's integration with upstream and downstream reaches

Objective 5: Minimize Maintenance Requirements

Criterion C5.1: Structural features—Maintenance requirements associated with structural features within project corridor

Criterion C5.2: Natural processes—Maintenance requirements associated with vegetation growth, erosion and sediment processes

Criterion C5.3: Urban flows—Maintenance requirements resulting from smaller, more frequent storm events and outfall flows

Criterion C5.4: Access—Incorporation of adequate access for maintenance crews and equipment

Objective 6: Protect the Quality and Availability of Water

Criterion C6.1: Water availability—Impact on ground-water recharge and on ability to maintain or improve the water supply functions in the project area

Criterion C6.2: Groundwater quality—Groundwater quality protection from contamination and the threat of contamination by preventing contaminant entry into groundwater

Criterion C6.3: Instream water quality—Water quality protection through vegetation and instream hydraulic complexity

Criterion C6.4: Storm-water management—Ability to enhance water supply and quality and reduce peak flows through local retention of rainfall and pollution prevention programs

Criterion C6.5: Flow regime—Ability to maintain geomorphically- and biologically-appropriate range of flows in terms of quantity and timing

Objective 7: Cooperate with Other Local Agencies to Achieve Mutually Beneficial Goals

Criterion C7.1: Mutual local goals—Ability to achieve project-specific goals and objectives developed jointly by the District and local agencies/municipalities

Criterion C7.2: Supports general plan—Ability to support goals and policies as stated in General Plan of partner agencies

Objective 8: Maximize Community Benefits Beyond Flood Protection

Criterion C8.1: Community safety—Overall safety for appropriate access and recreation

Criterion C8.2: Recreation—Quality of recreation experience provided by alternative

Criterion C8.3: Aesthetics—Quality of aesthetic form provided by alternative

Criterion C8.4: Open space—Incorporation of open space into alternative design

Criterion C8.5: Community support—Alternative reflects community concerns or feedback

Objective 9: Minimize Life-Cycle Costs

Criterion C9.1: Capital cost—Net Present Value of estimated capital cost

Criterion C9.2: Maintenance cost—Net Present Value of all maintenance costs over the life of the project

Criterion C9.3: Grant or cost-sharing opportunities—Net Present Value of grant or cost-sharing opportunities for project or project components

Objective 10: Impacts are Avoided, Minimized or Mitigated

Criterion C10.1: Compliance with San Francisco Bay Basin Plan—Assesses potential effects of Alternative on water quality via regulatory standards (Basin Plan)

Criterion C10.2: Identify the Least Environmentally Damaging Practicable Alternative (LEDPA)—Determines the preliminary LEDPA and ensures it is carried forward

5.5.2 Natural Flood Protection Evaluation Results

The first step of the NFP evaluation process is to establish relative weights (high, medium, or low) for each of the objectives. This was done by obtaining input from the following stakeholders:

- City of Milpitas Planning and Public Works staff at a meeting held on February 21, 2014.
- Members of the local community at a public information meeting held on June 14, 2014.
- District subject matter experts (SMEs) at a meeting held on November 12, 2014.

The assigned weights are shown in Appendix C.

The second step of the NFP evaluation process is to rate the feasible alternatives based on the individual criteria and overall objectives. The NFP evaluation methodology includes 10

objectives and 36 distinct criteria. SMEs rated each of the four feasible alternatives (Alternatives 1, 2A, 4, and 6) against all of the objectives and criteria. The Project team met with the SMEs on May 6, June 23, July 6, July 15, and July 23, 2015, to complete the rating process. The following SMEs participated:

- Brett Calhoun, Senior Water Quality Specialist
- Christy Chung, Associate Civil Engineer
- Pari Gharib, Assistant Engineer II
- Kurt Lueneburger, Senior Environmental Planner
- James Manitakos, Environmental Planner II
- Devin Mody, Engineering Unit Manager
- Zak Mousli, Senior Field Operations Administrator
- Matt Parsons, Biologist I
- Afshin Rouhani, Engineering Unit Manager
- Mark Wander, Vegetation Unit Manager
- Roy Weese, Associate Civil Engineer
- Liang Xu, Engineering Unit Manager
- Samuel Yung, Associate Civil Engineer

Some of the criteria required comparative ratings between the alternatives (for example, which alternative has the least or the most cost) while others were stand-alone ratings (for example, how well does the alternative meet community goals). Each feasible alternative was rated according to how well it accomplished each criterion. The ratings for the criteria under each objective were then compiled into a summary objective rating as defined by the NFP evaluation process. Table 5-3 shows the summary scores for all the alternatives. Completed NFP rating sheets are included in Appendix C. The result is a matrix (see Table 5-4) which shows a comparison of how well each alternative rated for each of the ten NFP objectives.

Table 5-3. NFP Scores for Lower Penitencia Creek Improvements Alternatives

Alternative	NFP Score
No Project	43.6
1	60.4
2A	76.1
4	71.3
6	28.2

The overall NFP scores varied greatly among the alternatives, ranging from 76.1 for Alternative 2A to 28.2 for Alternative 6. Alternative 6 was by far the lowest rated alternative because it is inconsistent with the watershed context, has poor ecological features including a reduction in both wetlands and riparian habitat, is not geomorphically sound, will not maintain or improve water quality, fails to meet community goals, and has high construction costs. Among the four alternatives, Alternative 1 received the third highest rating at 60.4. Alternative 1 rated high in watershed context, mutual benefits with other agencies, and life-cycle cost. However, it rated poorly in ecological benefits, geomorphology, maintenance requirements, and environmental impacts.

Alternatives 2A and 4 were the two highest rated alternatives with scores of 76.1 and 71.3, respectively. There is no substantial difference between the two alternatives in terms of level of

flood protection, geomorphology, maintenance requirements, protecting and enhancing water quality, or environmental impacts. Alternative 4 rated somewhat higher in ecological benefits; however, Alternative 2A rated higher in watershed context, achieving mutually beneficial goals with the City of Milpitas, and life-cycle costs. Overall, Alternative 2A best meets the District's Natural Flood Protection objectives.

Table 5-4. Natural Flood Protection Evaluation Feasible Alternatives Comparison Matrix

Objective	Objective Weight Rank	No Project	Alt 1	Alt 2A	Alt 4	Alt 6
1. Protection from Flood Damage	High	○	◑	◑	◑	◑
2. Watershed Context	High	○	◕	◕	◑	○
3. Ecology	Medium	○	◔	◕	●	○
4. Geomorphology	Medium	◔	◔	◕	●	○
5. Maintenance	High	◔	○	◔	◔	◔
6. Water Quality and Availabilty	Medium	◑	◑	◑	◕	○
7. Other Agency Support	Medium	◑	◕	◕	◑	○
8. Community Benefits	Low	◔	◔	◑	◑	○
9. Life-Cycle costs	Medium	●	◕	●	◑	○
10. LEDPA	Medium	◔	◑	◕	◕	○

Ratings Key:		
■	5	Outstanding
◕	4	Very Good
◑	3	Adequate
◔	2	Fair
○	1	Poor
X	0	Unacceptable

5.6 Staff-Recommended Project Development and Selection

The purpose of this section is to document the evaluation and refinement of the feasible alternatives and provide a qualitative comparison of the alternatives used to determine the staff-recommended project.

5.7 Alternatives Comparison

The purpose of this section is to document the evaluation of the feasible alternatives and provide a qualitative comparison of the alternatives used to determine the staff-recommended project.

Alternative 1

Alternative 1 requires the replacement of only one bridge. It does not include additional planted area downstream of I-880 on the west overbank.

Alternative 2A

The locations of levees/floodwalls are similar to Alternative 1. However, for Alternative 2A, the southern levee downstream of I-880 would be relocated 50 feet to the south and raised 4 feet. Alternative 2A requires the replacement of two bridges. This alternative reduces future maintenance requirements; it does not require future sediment removal. A parcel downstream of I-880 on the south bank would need to be acquired.

Alternative 4

The locations of levees/floodwalls are similar to Alternative 1. Like Alternative 2A, the southern levee downstream of I-880 would be relocated 50 feet to the south and raised 4 feet. On the Reach 3 west bank, the Alternative 4 west floodwall is 12 feet higher, compared to the other alternatives, because its base is lower (requiring partial removal of the existing levee). Like Alternative 2A, Alternative 4 also requires the replacement of two bridges. Also like Alternative 2A, Alternative 4 reduces future maintenance requirements; it does not require future sediment removal. A parcel downstream of I-880 on the south bank would need to be acquired.

Alternative 6

Alternative 6 was driven by community input at the June 2014 public meeting. It significantly changes the channel by adding approximately 3,000 lineal feet of concrete lining. It only requires the replacement of one bridge, and would require annual sediment removal.

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CHAPTER 6. STAFF-RECOMMENDED PROJECT

This section provides design basis, project element details, and right-of-way needs for the staff-recommended project. A description of the maintenance guidelines for the project is included in Section 7 and cost details are included in Section 8.

Upon completion of the Feasible Alternatives evaluation process, it was determined that Alternative 2A, which combines floodwalls, levees, and bridge replacements, is the highest ranked alternative. For this reason, the project team recommended Alternative 2A as the staff-recommended project.

6.1 Design Criteria

The following design criteria were used to develop the staff-recommended project.

6.1.1 General

- Project design life is 50 years.
- Flood protection improvements would be designed to convey the 1 percent design flow and meet District and FEMA freeboard requirements.
    - 3.0 feet of freeboard would be provided in sections of creek with levees or floodwalls.
    - 3.5 feet of freeboard would be provided at the upstream end of a levee, tapering to not less than the minimum of 3.0 feet at the downstream end of the levee.
    - 4.0 feet of freeboard would be provided in sections of creek within 100 feet of structures (e.g., a bridge) or wherever flow is constricted.
- Maintenance road widths will be determined independently for each site by consulting watershed maintenance staff for actual needs.
    - Maintenance roads would be a minimum width of 18 feet where possible.
    - For reaches where there is very low risk of large debris or trees entering the channel, the project team may maintain a minimum maintenance road width of 12 feet instead of 18 feet on at least one side of the channel.
    - A five-foot distance will be maintained between easement boundaries and the landward face of floodwalls.
- The project team has evaluated the project per the District's Board Governance Policies and determined that based on current information, anticipated sea level rise over the next 50 years will be accommodated within the project design.
    - Board Governance Policy E-4 states that: "There is water resources stewardship to protect and enhance watersheds and natural resources and to improve the

quality of life in Santa Clara County." The CEO interpretation of this policy describes the following strategy S-4.6: "Incorporate climate change mitigation and adaptation into District planning efforts." (July 28, 2014) For more details, see the December 2015 memo, "Starting Water Surface Elevation for Lower Penitencia at Coyote Creek."

- o Lower Penitencia Creek's starting water surface elevation takes into consideration low (0.51 feet), intermediate (1.01 feet), and high (2.59 feet) future sea level rise projections for Year-2070.
- o The 100-year flow and 10-year tide is the controlling case (compared with the 10-year flow and 100-year tide).

- The starting water surface elevation for Lower Penitencia Creek (at Coyote Creek confluence) is recommended to be 14.0 feet NAVD88.
- Lower Penitencia Creek's 1 percent water surface elevation at the Lower Berryessa Creek confluence point will not exceed 21.1 feet NAVD88.

6.1.2 Levees

- Levees will be built with side slopes of 2:1 (horizontal:vertical)
- Levee crest elevations will include allowances as necessary to account for settlement as determined by future design geotechnical investigations.

6.1.3 Vegetated Benches

- The vegetated benches would be constructed at the elevation of Mean Higher High Water (7.6 feet NAVD88) plus or minus 1 foot to provide suitable hydrology for growth of wetland vegetation.

6.1.4 Floodwalls

- The floodwalls would be constructed on the outboard side of the access roads at the levee crest.
- A minimum width of five feet will be maintained between the floodwalls and the right-of-way boundary to allow for access for inspection, debris removal, weed control, and other maintenance activities.
- Floodwalls in Reach 4 will tie in to San Andreas Drive and the Lower Berryessa Creek Project.
- The floodwalls will be designed per the U.S. Army Corps of Engineers Engineering Manual for Retaining and Floodwalls (EM 1110-2-2502, 1989) and FEMA standards.

6.1.5 Widen Bridge Opening

- The top-of-road elevations for the bridges shall remain as existing, to avoid impacts to adjacent roadways.

- Bridges will be designed per the American Association of State and Highway Transportation Officials (AASHTO) Load and Resistance Factor Design (LRFD) Bridge Design Specifications, the most current edition with California Amendments.

6.1.6 Pump Stations

- Access to the City of Milpitas pump stations in Reaches 2 and 4 will be preserved.

- Discussions will continue with the City of Milpitas on the need for flap gates at the pump station outfalls.

6.1.7 Recreational Features

- The existing pedestrian trail on the east levee and public boat ramp on the west bank in Reach 3 will be retained or replaced.

- In Reach 3 on the east bank, there is a City of Milpitas recreational trail on the outboard side of the levee which connects to the top of the east levee. A Joint Use Agreement between the District and the City of Milpitas, effective 1997 to 2022, governs changes to the trail. Ongoing coordination will continue with the City of Milpitas in the design phase, consistent with the existing agreement.

6.2 Staff-Recommended Project Description

The staff-recommended project for the Lower Penitencia Creek Improvements Project is Alternative 2A: Improvements with Widening of Bridge Openings (California Circle and Milmont Drive). Details of the levee relocation, vegetated benches, floodwalls, and bridge opening widening elements are described below. These elements will increase the capacity of all the project reaches to convey the design flow, provide channel stability, improve water quality and channel habitat, and reduce maintenance requirements.

6.2.1 Preliminary Design Elements

This alternative combines floodwalls, levees, vegetated benches, and widening the California Circle and Milmont Drive bridge openings. This would increase the capacity of all the project reaches to the design flow, provide channel stability, and improve water quality and channel habitat.

Along Lower Penitencia Creek, average floodwall/levee heights range from 4 to 5.5 feet; other proposed features are also described below:

- Reach 1
    - South bank: levee would be relocated 50 feet southward and raised 4 feet, creating area for a vegetated bench

- Reach 2
    - South bank: floodwall (5.5 feet high)
    - North bank: 40-foot-wide vegetated bench

- California Circle bridge opening and channel beneath widened by 25 feet (from 97 to 122 feet), existing soffit raised. Vertical wall supporting bridge on north side, instead of existing sloped concrete embankment. Channel bottom at north toe widened 40 feet. Bridge structure includes a pier wall in the center of the channel.

- Reach 3

    - Vertical wall under California Circle would be extended on the north side for 170 feet in the upstream direction.

    - Both banks: floodwalls (4 feet high)

- Milmont Drive bridge opening and channel beneath widened by 35 feet (from 97 to 132 feet), existing soffit raised. The proposed bridge would have a thinner deck supported by a pier wall, which maintains the existing top of roadway. Channel bottom at east toe raised to create vegetated bench and widened 25 feet. Bridge structure includes one splitter wall/set of piers in the center of the channel.

- Reach 4

    - Both banks: floodwalls (5 feet high)

Details for this alternative are provided in Appendix A.

Revised cost estimate

Construction:	$21,160,000
Land Acquisition:	$ 70,000
50-Year Maintenance:	$ 5,030,000
Total Lifetime Cost:	$26,260,000

The detailed cost estimate can be found in Appendix B.

Below are figures showing an overview of the project area.

Figure 6-1. Overview of Staff-Recommended Project

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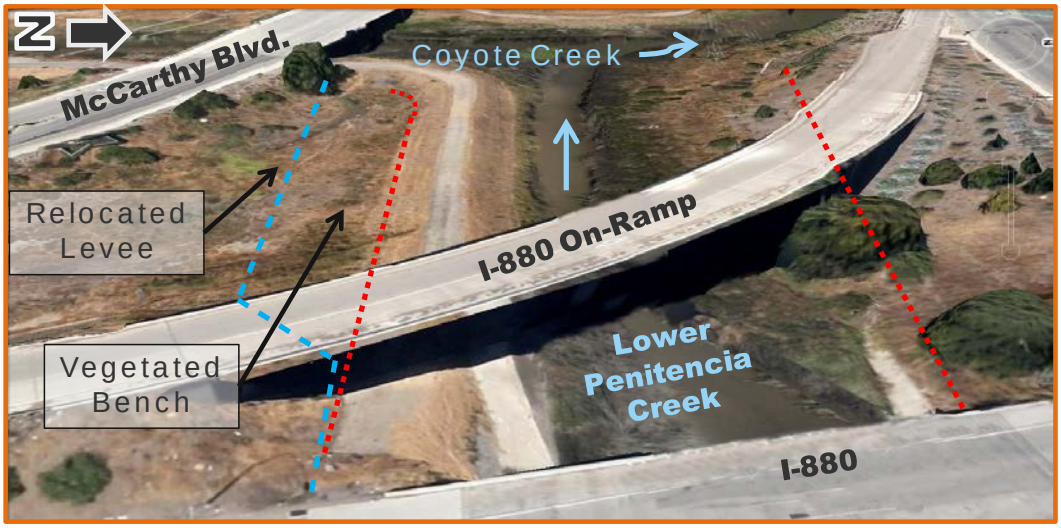
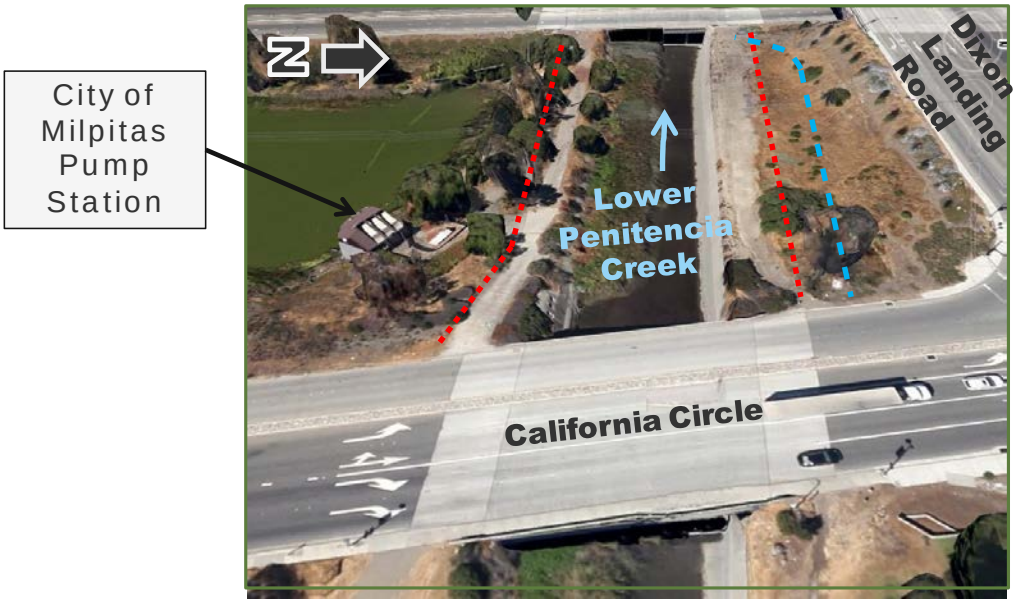


Google, Inc. 2014

Figure 6-2. Reach 1, Coyote Creek confluence to I-880



Google, Inc. 2014

Figure 6-3. Reach 2, I-880 to California Circle

Google, Inc. 2014

Figure 6-4. California Circle

Google, Inc. 2014

Figure 6-5. Reach 3, California Circle to Milmont Drive

Google, Inc. 2014

Figure 6-6. Milmont Drive

Google, Inc. 2014

Figure 6-7. Reach 4, Milmont Drive to San Andreas Drive

6.2.2 Levee

Downstream of I-880, the existing south levee would be relocated 50 or more feet southward and raised 4 feet, creating a vegetated bench with hydraulic connection to the creek. The bench will be suitable for active revegetation to create wetlands and/or riparian habitat. A levee is proposed in this area rather than floodwalls to better blend with the surrounding landscape.

Photo 6-1. Existing South Levee to be Relocated, Downstream of I-880 (looking east)

6.2.3 Vegetated Benches

- In Reach 1 downstream of I-880, a vegetated bench would be created in the area between the existing channel and the relocated south levee.
- In Reach 2 between I-880 and California Circle, a vegetated bench would be created on the north bank. The maintenance road will be shifted slightly north to accommodate the new vegetated bench.

These vegetated benches would provide mitigation for temporary impacts to wetlands and aquatic habitat resulting from project construction.

Photo 6-2. Location of Proposed Vegetated Bench Downstream of I-880, South Overbank

Photo 6-3. Location of Proposed Vegetated Bench Downstream of California Circle, North Bank (looking east)

6.2.4 Floodwalls

In Reaches 2, 3, and 4, floodwalls would be installed in areas requiring flood protection. Concrete floodwalls were chosen in this area over levees as there is limited right-of-way along the creek, and floodwalls would have a smaller footprint than higher levees. The approximate height of the project floodwalls would be:

- Reach 2: South bank, floodwall 5.5 feet high
- Reach 3: Both banks, floodwalls 4 feet high
- Reach 4: Both banks, floodwalls 5 feet high

Along Reaches 2 and 4, there are existing City of Milpitas pump stations that would be blocked by the floodwalls. Vehicular access to these pump stations needs to be preserved.

Along a portion of Reach 3, parcels on the west side of the channel are being redeveloped for residential use, as shown in Figure 6-8.

- Residential development at 1494/1600 California Circle (Waterstone): In 2015, these two parcels were re-graded to increase the elevation of the site to approximately 0.4 feet below the existing top of levee elevations. A 6.5- to 8.5-foot-tall retaining wall has been built along the southern edge of the parcel (along the BAPS Shri Swaminarayan Mandir parcel at 1430 California Circle), and has been tied in to the existing creek levee.

- Residential development at 1210 California Circle: Plans are underway to re-grade the site so that the land adjacent to the levee will be at the same elevation as the existing top of levee. The future pads for the homes closest to the levee will be to 1.6–2.5 feet below the existing top of levee. Grading is expected to begin in 2016. Construction is expected to take two years. A 4-foot-tall retaining wall will surround most of the site. Along the northern edge of the property (along the BAPS parcel), a portion of the retaining wall will be 7 feet tall and will be keyed in to the existing creek levee.

Once all four parcels on the west overbank between California Circle and Milmont Drive are re-graded, it may be possible to reduce the floodwall design heights.

Table 6-1. Proposed Floodwall/Levee Heights on Lower Penitencia Creek

Reach	Location	Structure Type	Left Bank Height (ft)	Right Bank Height (ft)
1	Coyote Creek confluence to I-880	Levee	4	--
2	I-880 to California Circle	Floodwall	5.5	--
3	California Circle to Milmont Drive	Floodwall	4	4
4	Milmont Drive to San Andreas Drive	Floodwall	5	5

Figure 6-8. Parcels Being Redeveloped

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6.2.5 Widening of Bridge Openings

- The California Circle and Milmont Drive bridge openings would be widened and the soffits would be raised.

Photo 6-4. California Circle Bridge, Downstream Face

Photo 6-5. Milmont Drive Bridge, Downstream Face

Photo 6-6. Discharge from City of Milpitas California Circle Pump Station, Downstream of California Circle, South Bank

Photo 6-7. City of Milpitas California Circle Pump Station, Downstream of California Circle, South Overbank

Photo 6-8. City of Milpitas California Circle Pump Station, Downstream of California Circle, South Overbank

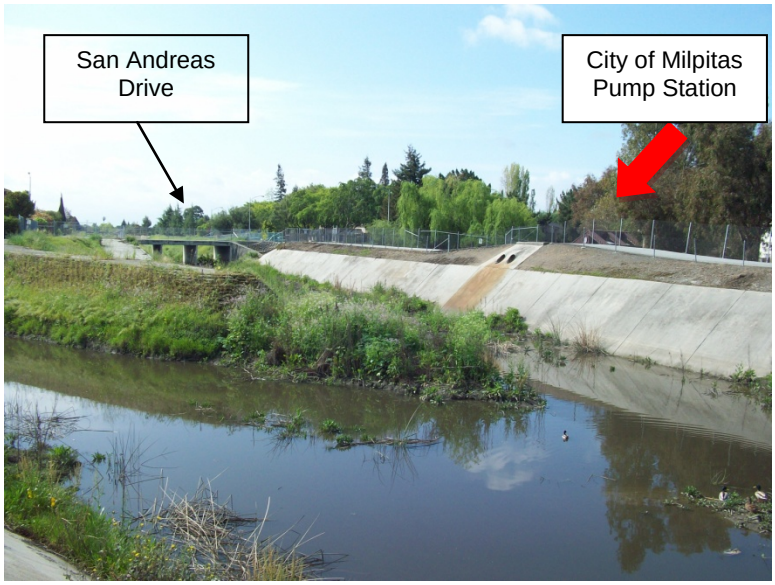

Photo 6-9. City of Milpitas Abbott Avenue Pump Station, Downstream of San Andreas Drive, West Overbank

Operation and Maintenance

New maintenance activities due to the construction of Alternative 2A would be limited to an anticipated increase in graffiti removal due to the installation of new floodwalls. Other maintenance activities under Alternative 2A, such as trash and debris removal and mowing the channel banks would be the same as under the existing condition. Construction of Alternative

2A is anticipated to significantly reduce, if not eliminate, the need for sediment removal and vegetation management activities.

In Reach 2 between I-880 and California Circle, a vegetated bench would be created on the north bank. The maintenance road will be shifted slightly north to accommodate the new vegetated bench.

Where the channel is widened under the bridges, the additional channel area will be at the MHHW elevation, to prevent future sedimentation.

Land Ownership/Access

Replacing the existing vehicular bridges at California Circle and Milmont Drive would require coordination with Caltrans and permits from the City of Milpitas. Between the Coyote Creek confluence and I-880, relocation of the existing south levee would free up room for creation of a vegetated bench in the channel. Acquisition of right-of-way from the City of Milpitas would be required to relocate the levee and create the vegetated bench. All other works would occur within the District easement or fee title.

6.3 Right of Way Requirements

It is expected that a parcel of land in Reach 1 would need to be acquired by the District in fee or easement for the construction of the staff-recommended project. That parcel (Assessor's Parcel No. 022-30-041) is owned by the City of Milpitas and is located south of the channel between McCarthy Boulevard and Interstate 880.

6.4 Agency Approval Requirements

The staff-recommended project would require approval by the following agencies:

- **U. S. Army Corps of Engineers (Corps)**—Federal Clean Water Act (CWA) Section 404 permit requires Corps authorization for work involving intentional or unintentional placement of fill or discharge of dredged materials into any "waters of the United States." The staff-recommended project would require construction within the Lower Penitencia Creek channel below the ordinary high water (OHW) mark in the "waters of the United States"; therefore, a Section 404 permit would be required from the Corps Regulatory Division.

- **San Francisco Bay Regional Water Quality Control Board (RWQCB)**—Federal Clean Water Act Section 401 Water Quality Certification (WQC) and California Porter-Cologne Act Waste Discharge Requirements (WDR). Federal CWA Section 401 requires that every applicant for a Corps CWA Section 404 permit or Rivers and Harbors Act Section 10 permit must receive certification from the RWQCB that the proposed activity would not violate State and/or Federal water quality standards. Since the staff-recommended project would require a Section 404 permit, a Section 401 WQC would be required as well as a WDR permit. Typically, the RWQCB issues a combined permit covering both Section 401 WQC and WDR.

- **U. S. Fish and Wildlife Service (USFWS)**—Federal Endangered Species Act of 1973 (as amended) and Migratory Bird Treaty Act (16 U.S.C. 703 et seq). If a project may result in "incidental take" of a listed species, an incidental take permit is required. An

incidental take permit allows a non-Federal landowner to proceed with an activity that is legal in all other respects, but that results in "incidental taking" of a listed species. USFWS also implements the Migratory Bird Treaty Act (MBTA) which prohibits harm to migratory birds. The staff-recommended project may affect the federally endangered salt marsh harvest mouse (*Rheithrodontomys raviventris*) and a number of migratory birds. An incidental take permit from USFWS may be required, depending on the outcome of wildlife studies to be performed in support of the project. Impacts to migratory birds can usually be avoided through pre-construction surveys and establishment of buffers around active nests.

- **California Department of Fish and Wildlife (CDFW)**—California Fish and Game Code Section 1602 Streambed Alteration Agreement (SAA). CDFW Code section 1602 requires any person, State or local governmental agency, or public utility to notify CDFW before beginning any activity that would do one or more of the following: (1) substantially obstruct or divert the natural flow of a river, stream, or lake; (2) substantially change or use any material from the bed, channel, or bank of a river, stream, or lake; or (3) deposit or dispose of debris, waste, or other material containing crumbled, flaked, or ground pavement where it can pass into a river, stream, or lake. The staff-recommended project would require an SAA. The staff-recommended project area also likely contains habitat for the state protected longfin smelt (*Spirinchus thaleichthys*). Impacts to longfin smelt can usually be avoided by performing construction in summer and fall when longfin smelt are not found in the South San Francisco Bay and its tributaries. If avoidance of impacts is not possible, an incidental take permit from CDFW would be required under California Fish and Game Code section 2050.

- **Bay Conservation and Development Commission (BCDC)**—Under the McAteer-Petris Act, BCDC has regulatory authority over development of submerged lands, tidelands, and marshlands of Coyote Creek and its tributaries up to the eastern most point of Newby Island. The staff-recommended project area is located about 900 ft upstream of Newby Island. Because the project area would be wholly outside the jurisdictional area of BCDC, the staff-recommended project would not require approval by BCDC.

- **State Water Resources Control Board (SWRCB)**—National Pollutant Discharge Elimination System (NPDES) Permit for discharge of storm water from construction and land-disturbing activities. A NPDES permit is required from SWRCB for any construction project disturbing over 1-acre in size. The staff-recommended project would disturb far more than one acre and would require coverage under the General Construction Permit issued by SWRCB. To obtain coverage the District would prepare a Storm Water Pollution Prevention Plan (SWPPP) and submit a Notice of Intent to SWRCB.

- **National Oceanic and Atmospheric Administration National Marine Fisheries Service (NMFS)**—Endangered Species Act compliance for marine mammals, saltwater fish, and anadromous fish. The staff-recommended project would not be expected to affect habitat for species under authority of NMFS.

- **Other State and Local Agencies**—Other construction/building/grading permits required for earthwork, storm water pollution prevention plans, and encroachment on existing rights-of-way. The staff-recommended project would require construction on bridges

and roadways owned by the City of Milpitas. A construction permit and encroachment permit would be required from the City of Milpitas.

6.5 Environmental and Recreational Enhancement Opportunities

Existing Environmental and Recreational Features

The project area is almost completely urbanized. Lower Penitencia Creek channel is bordered to the north and east by commercial and residential uses. To the south and west are City of Milpitas-owned properties, City of Milpitas-owned pumping stations, commercial offices and single- and multi-family residential development (under construction). Existing substantial environmental resources of the project area include:

- Federal-jurisdictional riverine wetlands within the creek channel in Reaches 1 through 4 (USFWS, 2015b).
- Federal-jurisdictional palustrine wetlands located at the detention pond operated by the City of Milpitas to the south of Reach 2 (USFWS, 2015b).
- Open water habitat within the creek channel that qualifies as waters of the U.S. and waters of the state.
- Aquatic and riparian habitat adjacent to Coyote Creek near the Lower Penitencia Creek confluence.
- Riparian habitat on the central island and levees in Reach 3.
- Potential habitat for the state-threatened longfin smelt (*Spirinchus thaleichthys)* in tidally influenced portions of the channel in Reaches 1 through 4 (CDFW, 2014).
- Potential habitat for the state species of special concern Western pond turtle (*Actinemys marmorata*) in Reaches 1 through 4 (CDFW, 2014).
- Habitat for migratory nesting birds in Reaches 1 through 4 (CDFW, 2014).

Existing substantial recreational resources of the project area include:

- Penitencia Creek Trail located on the east bank levee in Reach 3 (i.e., between California Circle and Milmont Drive bridges).
- Coyote Creek Trail located on east bank of Coyote Creek south of the confluence with Lower Penitencia Creek (the northern terminus of the trail is at North McCarthy Boulevard, about 200 feet south of the confluence).
- Public boat ramp located on the west bank in Reach 3 and accessible from California Circle.

Environmental Opportunities

The project area provides environmental and recreational opportunities. The proposed project will increase the flow conveyance capacity of the creek through channel enlargement,

reconstruction of levees, and/or addition of floodwalls. The enlarged channel will be able to convey the 1% flow, but the amount of water flowing in the channel during lesser events will be unchanged. Therefore no increase in open water habitat is expected. However, channel enlargement will create opportunities to increase wetlands and riparian habitat within the channel. The currently undeveloped land on the south/west bank in Reach 1 is owned by the City of Milpitas and available for creation/restoration of wetlands/riparian habitat by relocating the existing levee farther from the creek centerline (Moneda, 2014). The District would have to acquire this property to implement this environmental opportunity. Enlargement of wetlands and riparian habitat could also be designed into the project at Reaches 2 and 3 during channel widening. Active planting of enlarged floodplains in Reaches 1, 2, and 3 would help native plants establish instead on non-native or invasive plants. Native plants generally have greater ecological value than non-native or invasive plants. The habitat would benefit the western pond turtle and nesting birds. Reach 2 and 3 ecological opportunities would not require land acquisition by the District.

Project design could factor in natural accumulation of sediment in the channel when determining the means to provide required flow conveyance capacity. This would eliminate the need for future sediment removal in the channel while providing flood protection. This would benefit both aquatic and riparian species by avoiding future periodic disruption of aquatic and wetlands habitat during sediment removal. Impacts directly resulting from sediment removal include removal of vegetation, generation of noise and dust, and stress on plants and wildlife due to dewatering.

Recreational Opportunities

The existing Lower Penitencia Creek trail in Reach 3 should be considered if the east bank levee in Reach 3 is reconstructed. The levee crest access road could have a second function as a trail. If located on the levee crest, this trail would have greater visual connectivity to the creek than the existing trail, parts of which are separated from the creek by the existing levee. This would be a recreational enhancement. Design of the floodwalls would need to accommodate the connection between the levee crest and the existing trail at street level.

The west bank levee in Reach 3 does not have an existing recreational trail, although unauthorized use of the levee-crest road by pedestrians does occur. The project would reconstruct this levee, which provides an opportunity to include a trail as a recreational enhancement. Residential development is under construction on the parcels adjacent to the District right-of-way in Reach 3. Project design could include convenient connections between a Reach 3 west bank trail and that development.

The existing boat ramp in Reach 3 is surfaced with concrete and is in good condition. A curb cut on California Circle adjacent to the existing bridge facilitates vehicular access to the ramp. However, access from California Circle is challenging due to the lack of pavement between the Circle and the top of the ramp. Additionally, the boat ramp is not marked. The proposed project would reconstruct the California Circle bridge. The design of the reconstructed bridge could incorporate a curb cut, signage, and pavement connecting to the ramp to enhance this recreational feature.

Recreation elements shall not limit the District's ability to operate and maintain these reaches of Lower Penitencia Creek, consistent with agreements between the District and the City of Milpitas.

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CHAPTER 7. MAINTENANCE PROGRAM

7.1 Maintenance History

Regular maintenance has been conducted in Lower Penitencia Creek since at least the 1980s, including sediment removal, trash and debris removal, and vegetation management.

7.2 Stream Maintenance Program

The Stream Maintenance Program (SMP) began in 2002 and was granted permits to undertake maintenance activities. The program covers routine activities such as sediment removal, bank protection, vegetation management, and minor maintenance activities. A second iteration of the program, SMP2, began in 2014. It is a ten-year program with five-year permits.

Under the SMP and SMP2, sediment was removed from the project area on three occasions: 2004, 2005, and 2015. Prior sediment removals, which required individual permits from regulatory agencies, were conducted in years 1983, 1984, 1985, 1986, 1988, 1989, and 1997. See Table 7-1 below.

Table 7-1. Sediment Removal Maintenance History

Calendar Year	Location	Project Reaches	Length (ft)	Volume (CY)
1983	D/S Interstate 880 to Coyote Creek	1	600	2,460
1984	U/S California Circle to Berryessa Creek	3, 4	3,100	4,000
1985	U/S California Circle to Berryessa Creek	3, 4	3,100	15,000
1986	U/S California Circle to Berryessa Creek	3, 4	3,100	9,600
1988	U/S California Circle to Berryessa Creek	3, 4	3,200	4,000
1989	D/S San Andreas Drive	3, 4	3,800	4,215
1997	Milmont Drive to California Circle	3	3,600	17,790
2004	Milmont Drive to San Andreas Drive	4	1,000	3,630
2005	California Circle to Milmont Drive (secondary channel only)	3	2,800	3,656
2015	I-880 to Lower Berryessa Creek confluence	2,3,4	3,900	33,300

In 2004, the reconstruction of the Interstate 880 and Dixon Landing Road interchange project was completed. Sediment was removed from the channel as part of the project.

In addition to sediment removal, the District conducts the following maintenance activities:

- Vegetation control on and adjacent to levees by mowing and spraying
- Trash and debris removal at bridges and along access roads and in the channel
- Natural and low-flow channel maintenance
- Graffiti abatement

7.3 Ongoing Maintenance Activities

Sediment Maintenance: The Stream Maintenance Program allows for sediment removal on Lower Penitencia Creek from upstream Interstate 880 to upstream of Milmont Drive. Watershed staff evaluates channel conditions annually to identify necessary future maintenance activities. Sediment removal will be performed on an as-needed basis per the SMP2.

Vegetation Maintenance: The following vegetation maintenance would be performed on an annual cycle:

- ***Levees**:* Prevent vegetation growth along top of levee maintenance road, prevent woody and shrub vegetation establishment and growth on levee slopes or top. Continue current vegetation control by mowing and spraying. Future woody growth removal will require hand removal.

- ***Natural and Low-Flow Channels**:* Monitor for hazardous tree conditions, channel blockages and other conditions that would impede flow or create local drainage problems. Continue current vegetation management practices.

Structural Maintenance: The following structural maintenance is performed on an annual cycle (unless otherwise noted):

- ***Levees**:* Levee tops and slopes would be monitored for erosion damage and repaired as needed.

- ***Maintenance Access Roads**:* Paved maintenance roads would be monitored for cracking and potholes and repaired as needed. Aggregate base roads would be monitored for erosion and potholes and repaired as needed and measures taken to prevent vegetation growth.

Debris/Graffiti Removal: Debris and graffiti removal will continue per the District Good Neighbor Program. It consists of both monthly and quarterly cleanup events, response to graffiti and trash complaints, repair/install fences, and signs around District facilities.

7.4 Staff Recommended Project Maintenance Cost

The estimated additional annual maintenance costs for the staff-recommended project are summarized in Table 7-2. Costs were escalated to the 50-year total value using a 3.0% compounding inflation rate; the net present value was calculated using a 2.5% effective interest rate.

Table 7-2. Estimated Additional Annual Maintenance Cost

Activity	Alternative 2A
Graffiti Removal	$11,000
Vegetation Management	$76,000
Total per Year	$87,000
Over 50 Years (Net Present Value)	**$5,030,000**

CHAPTER 8. UPDATED PROJECT COST, FUNDING, AND SCHEDULE

8.1 Project Cost

8.1.1 Capital Cost

The staff-recommended project combines floodwalls, levees, vegetated benches, and replacing the California Circle and Milmont Drive bridges. This will increase the capacity of all the project reaches to the design flow, provide channel stability, and improve water quality and channel habitat.

Along Lower Penitencia Creek, average floodwall/levee heights range from 4 to 5.5 feet; other proposed features are also described below:

- Reach 1
  - West bank: levee will be relocated 50 feet westward and raised 4 feet, creating area for a vegetated bench
- Reach 2
  - West bank: floodwall (5.5 feet high)
  - East bank: 40-foot-wide vegetated bench
- California Circle bridge opening widened by 25 feet, existing soffit raised
- Reach 3
  - Vertical wall under California Circle would be extended on the north side for 170 feet in the upstream direction.
  - Both banks: floodwalls (4 feet high)
- Milmont Drive bridge opening widened by 35 feet, existing soffit raised
- Reach 4
  - Both banks: floodwalls (5 feet high)

Details for this alternative are provided in Appendix A.

Revised cost estimate:

Construction:	$21,160,000
Land Acquisition:	$ 70,000
50-Year Maintenance:	$ 5,030,000
Total Lifetime Cost:	$26,260,000

The detailed cost estimate can be found in Appendix B.

The overall capital cost for the staff-recommended project would be $21.2 million in 2015 dollars including construction, land acquisition, contingency, and inspection and mitigation.

The capital estimate is summarized below in Table 8-1. A detailed cost estimate is provided in Appendix B.

Table 8-1. Staff-Recommended Project Capital Cost Estimate

Project Elements by Reach	Cost (2015 dollars)
Phase I – Levee & Floodwall Work	
Reach 1	$240,000
Reach 2	$1,046,000
Reach 3	$8,295,000
Reach 4	$1,365,000
Phase II	
California Circle	$6,066,000
Phase III	
Milmont Drive	$4,146,000
Land Acquisition	
City of Milpitas parcel by McCarthy Blvd & I-880	$70,000
Total Project Capital Cost	$21,230,000

8.1.2 Maintenance Cost

The maintenance cost for the staff-recommended project would be $87,000 per year.

Table 8-2. Staff-Recommended Project Maintenance Cost Estimate

Activity	Alternative 2A
Graffiti Removal	$11,000
Vegetation Management	$76,000
Total per Year	$87,000
Over 50 Years (Net Present Value)	$5,030,000

The total maintenance cost for the 50-year life of the project assuming a 3.0% compounding inflation rate and a 2.5% effective interest rate would be $5.0 million dollars (net present value).

8.2 Project Funding

The preliminary staff-recommended project cost is as follows:

Construction:	$21,160,000
Land Acquisition:	$ 70,000
50-Year Maintenance:	$ 5,030,000
Total Lifetime Cost:	$26,260,000

The detailed cost estimate can be found in Appendix B.

Funding for this project is anticipated to be allocated partially from California Department of Water Resources Proposition 1E, Round 2 Stormwater Flood Management Grant 4600010375. The total grant of $30 million would be used to sponsor the Lower Berryessa, Lower Penitencia, and Upper Berryessa Improvements. The rest of the funding for this project will be from the District's Stream Stewardship funds.

The cost of construction and land acquisition for the staff-recommended project is $21.2 million in 2015 dollars.

8.3 Project Schedule

The preliminary Project schedule is as follows in Table 8-3:

Table 8-3. Project Schedule

Major Milestones	End Date
Final Planning Study Report	May 2016
Start of Design	June 2016
Certification of EIR	July 2017
100% Plans and Specifications Approval	March 2018
Regulatory Permits Acquired	March 2018
Start of Construction	June 2018

Project design is expected to begin in June 2016. Design, plans and specifications preparation, and permit acquisition would be conducted from June 2016 to March 2018. Construction would be conducted in 2018 and 2019.

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APPENDIX A

Alternative Details

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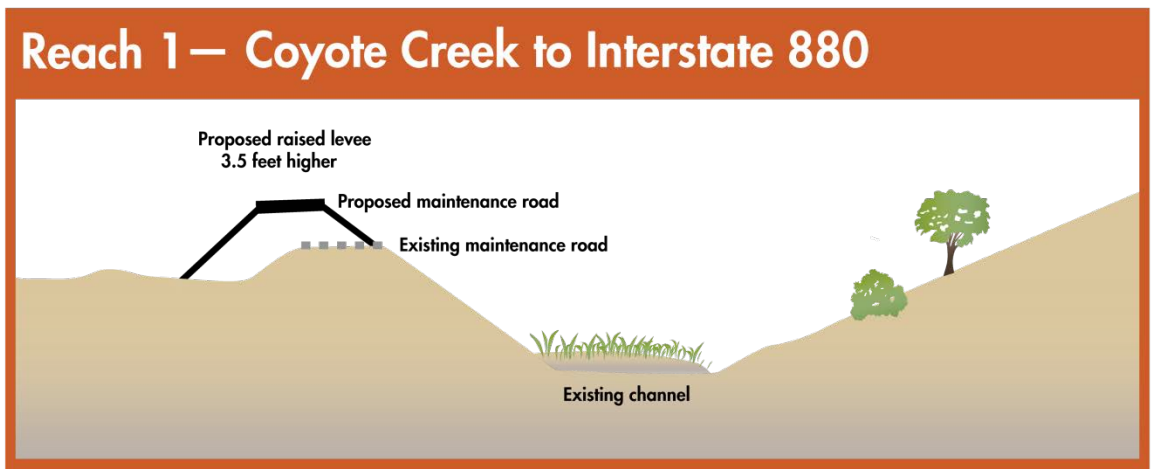
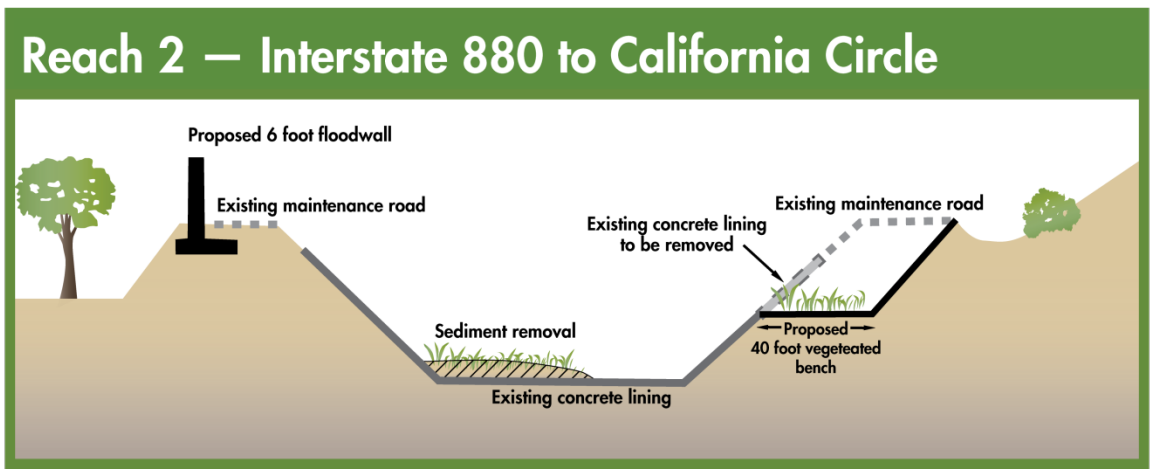
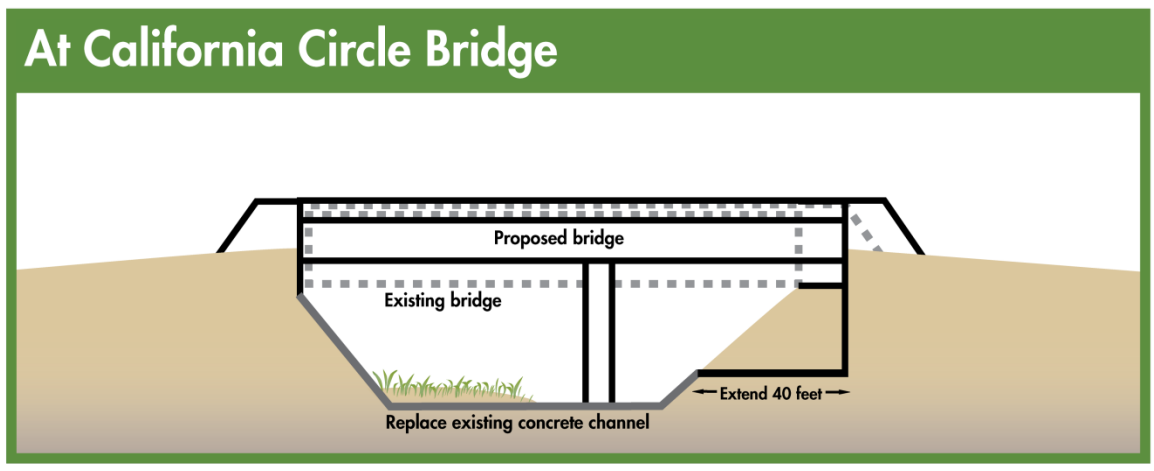
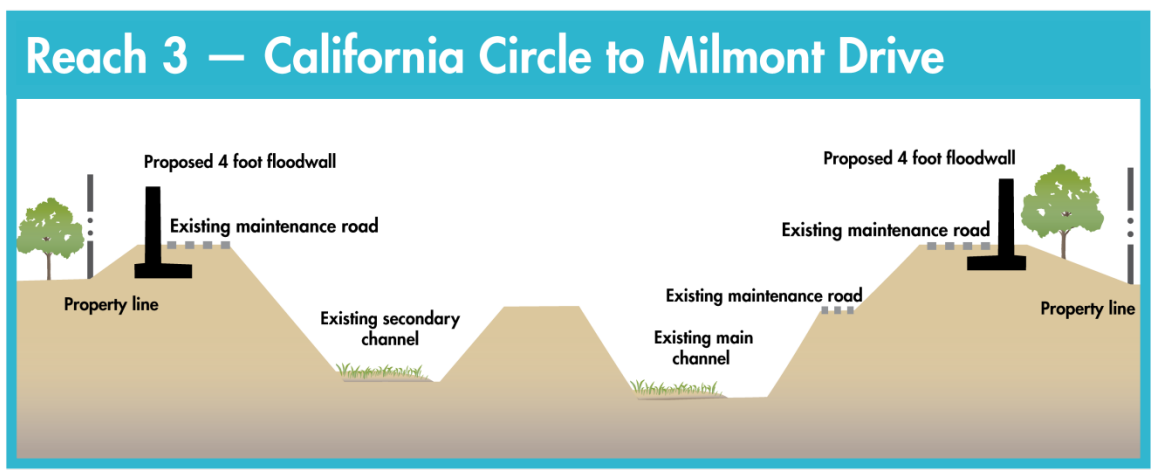
Alternative 1 – Widened California Circle Bridge with SMP2 Sediment Removal (R2 & R4)

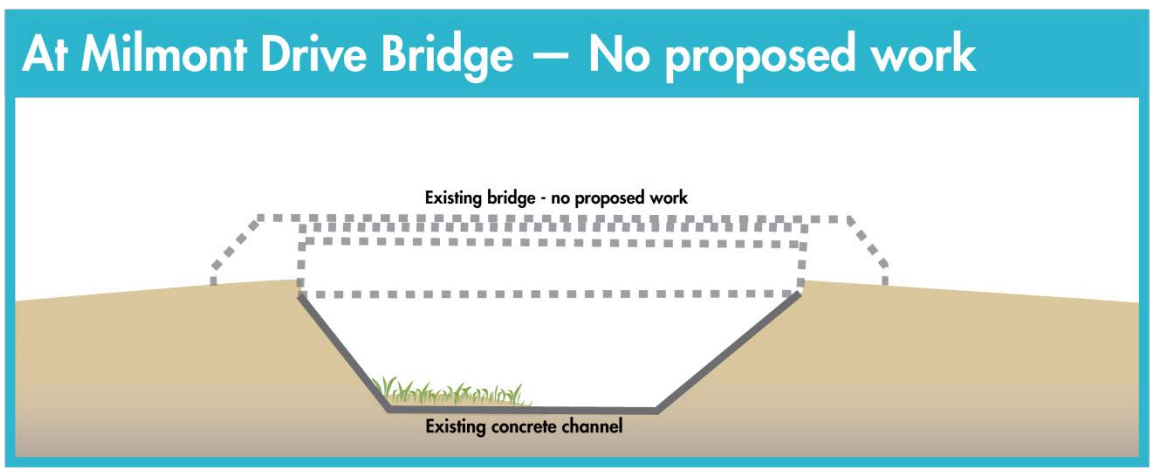
Levee Raising (R1), Vegetated Bench (R2), Floodwalls, & Widen California Circle

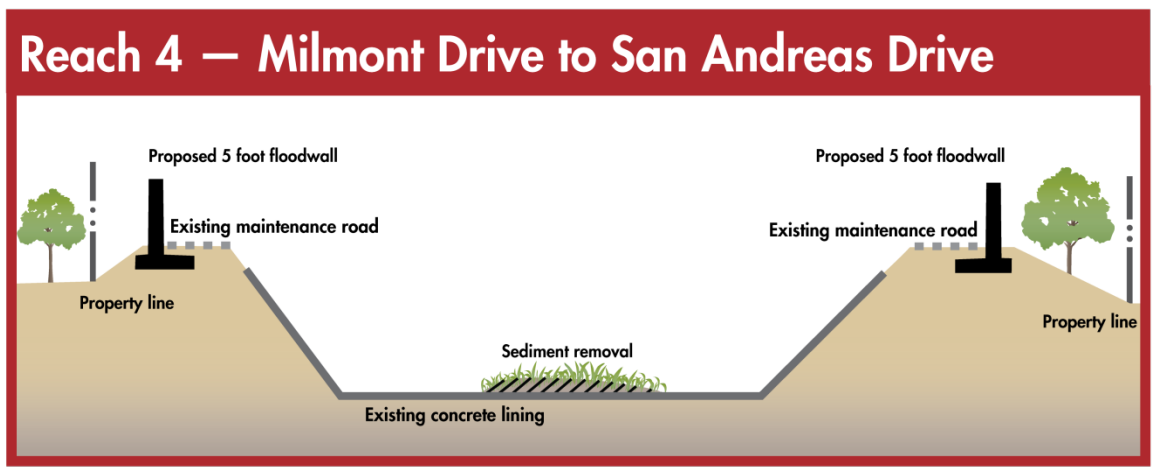












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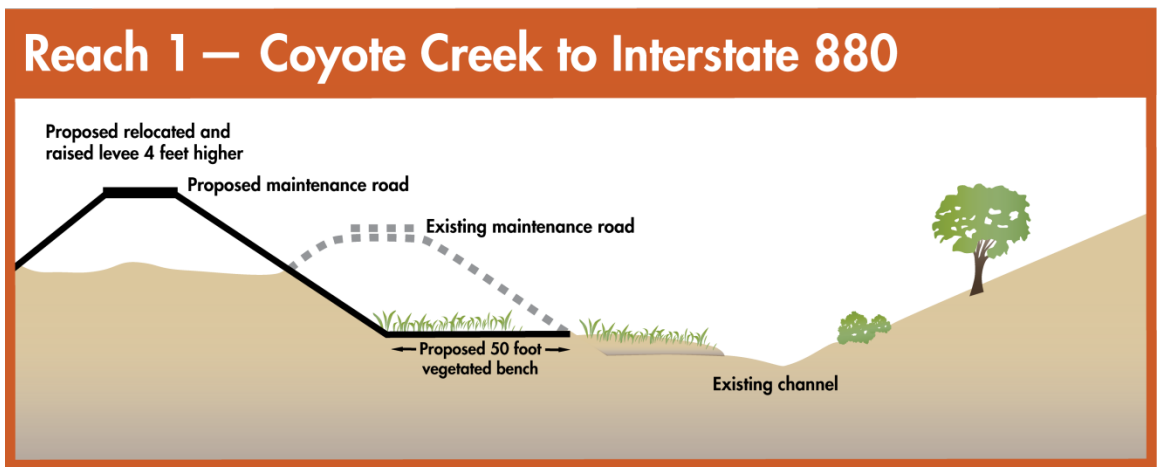
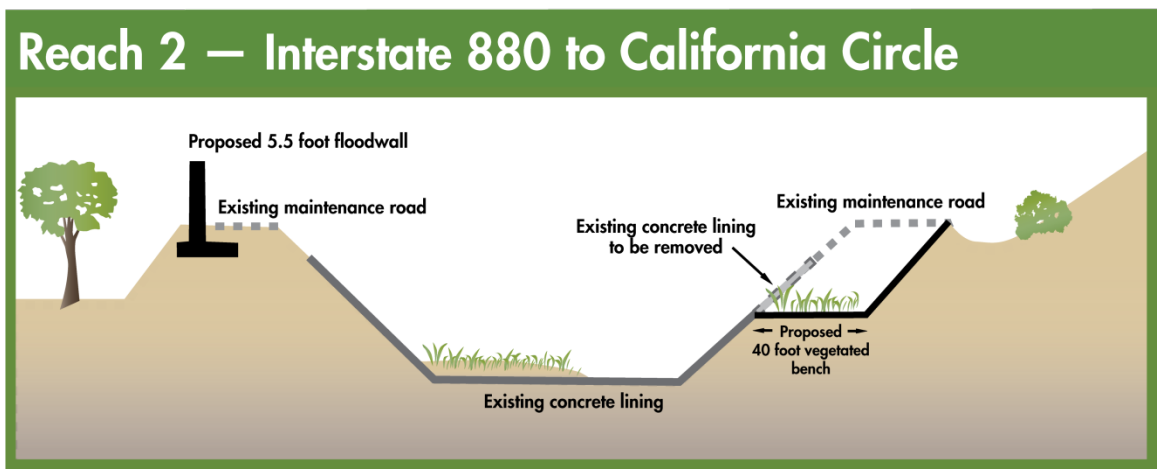
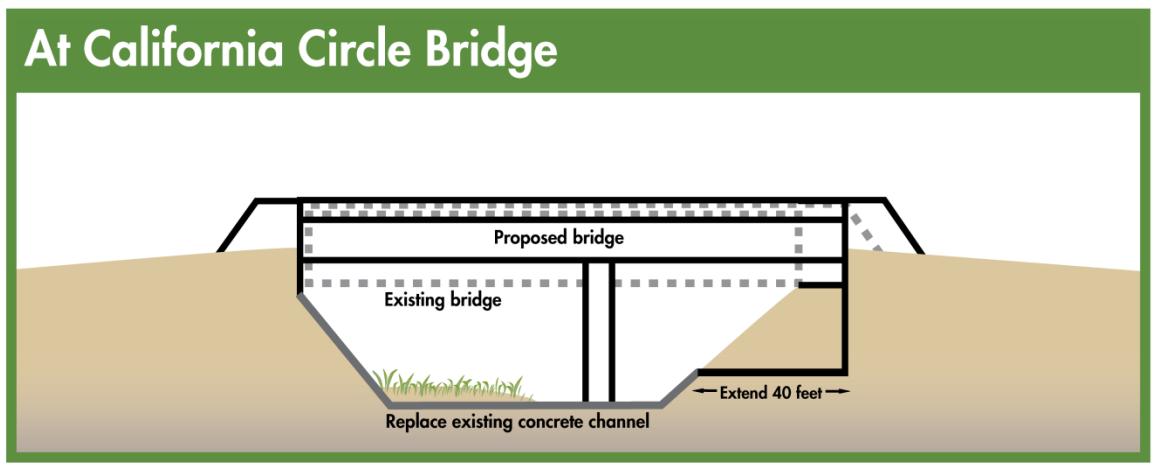
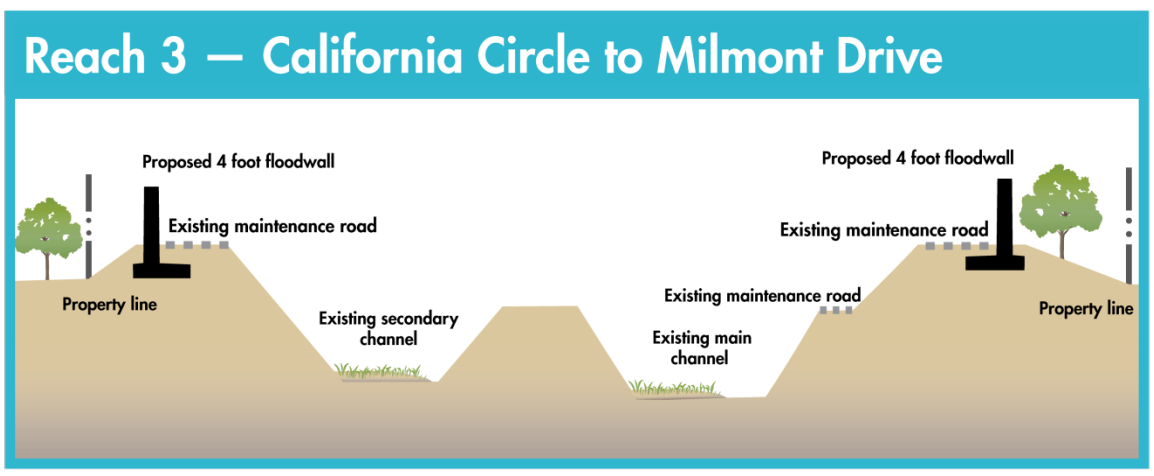
Alternative 2A – Improvements with Bridge Widening (California Circle and Milmont Drive)

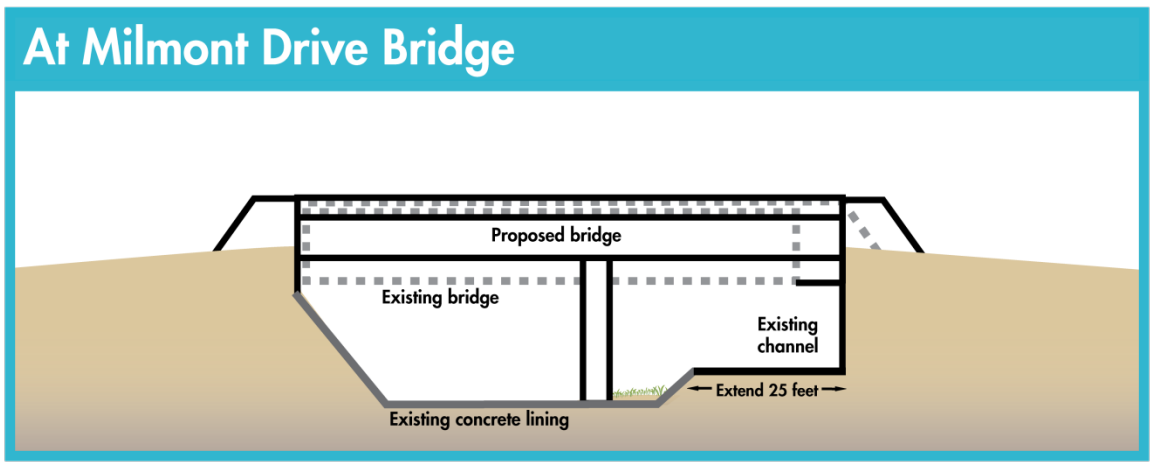
Levee Relocation (R1), Vegetated Benches (R1&2), Floodwalls, & Widen Both California Circle and Milmont Drive

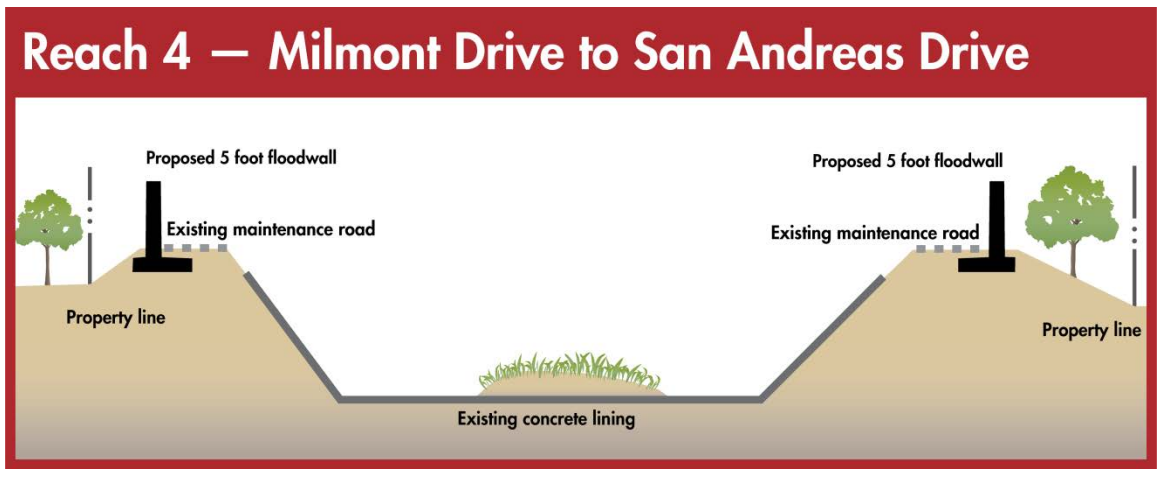












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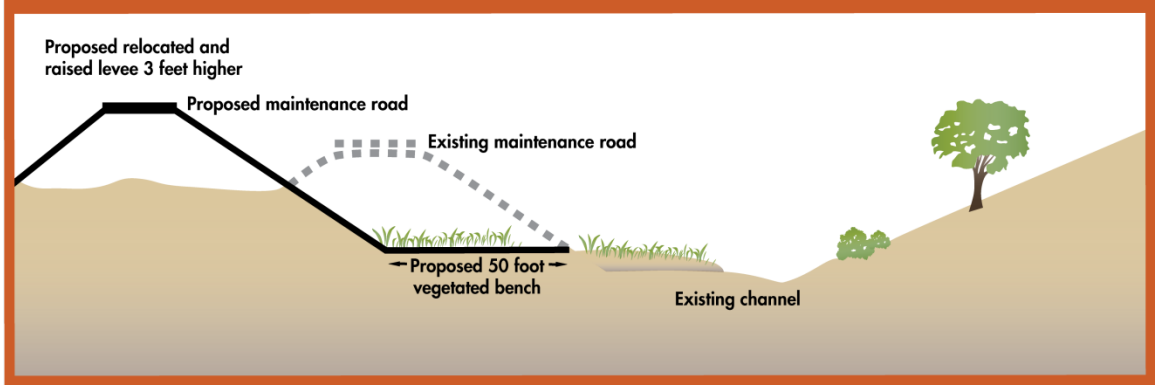
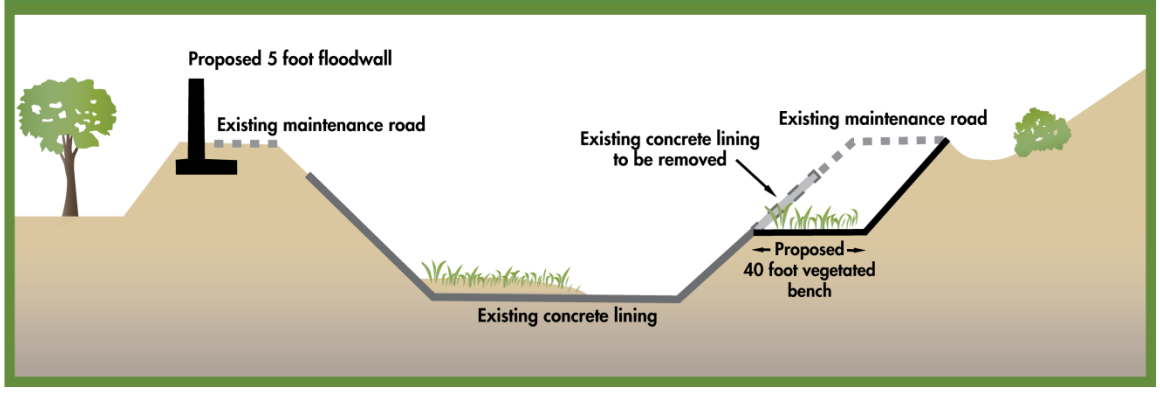
Alternative 4 – West Bank Widening (R3) with Bridge Widening (California Circle and Milmont Drive)

Levee Relocation (R1), Vegetated Benches (R1, 2, 3), Floodwalls, & Widen California Circle and Milmont Drive

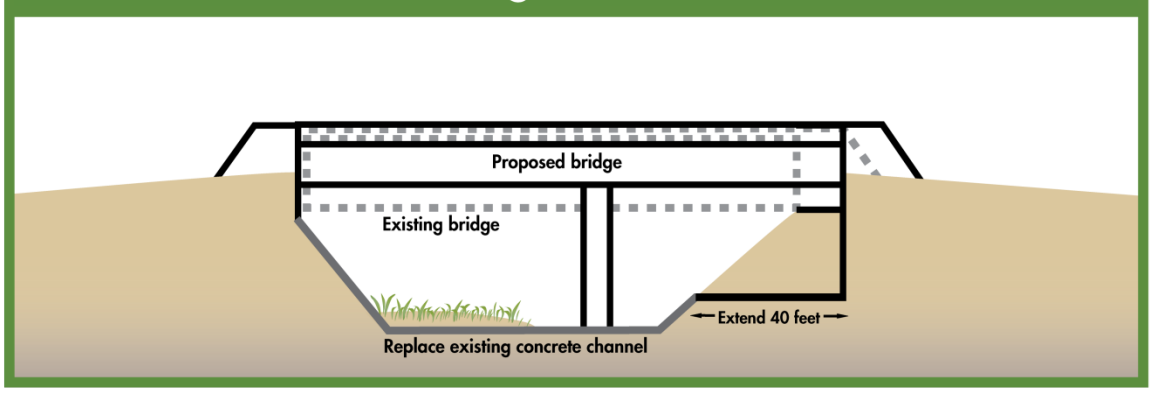
Reach 1 — Coyote Creek to Interstate 880



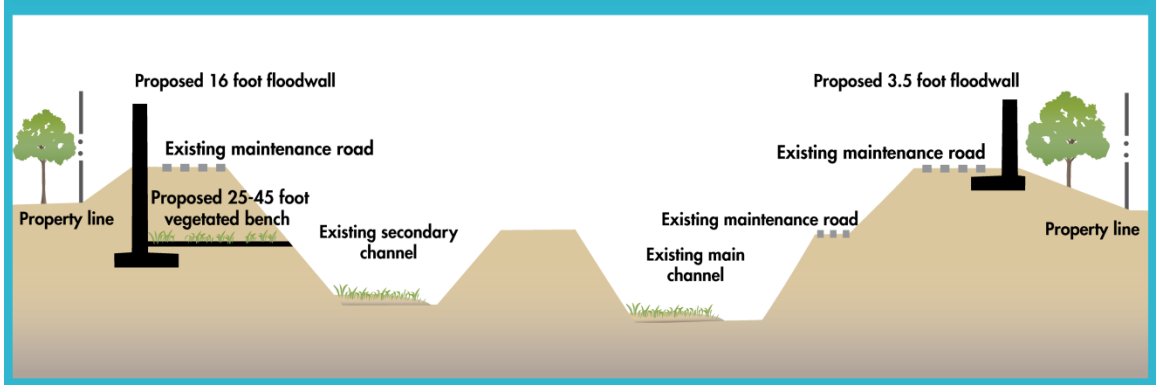
Reach 2 — Interstate 880 to California Circle



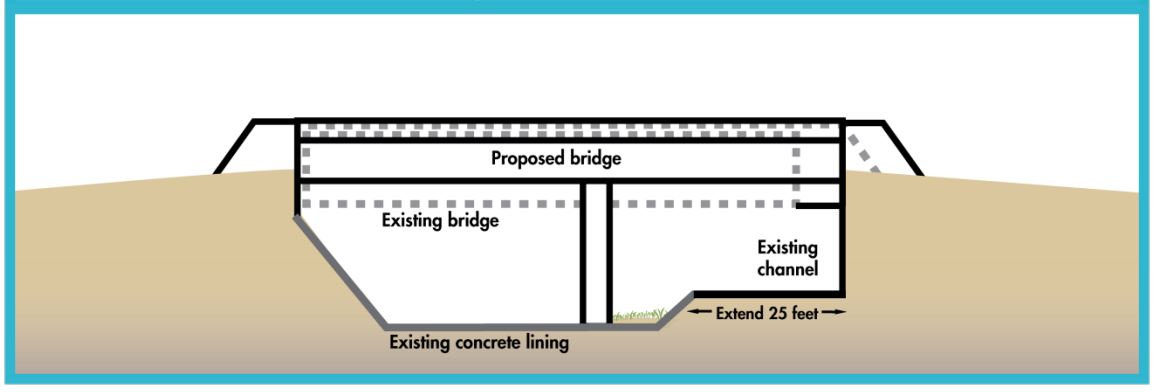
At California Circle Bridge



Reach 3 — California Circle to Milmont Drive



At Milmont Drive Bridge



Reach 4 — Milmont Drive to San Andreas Drive

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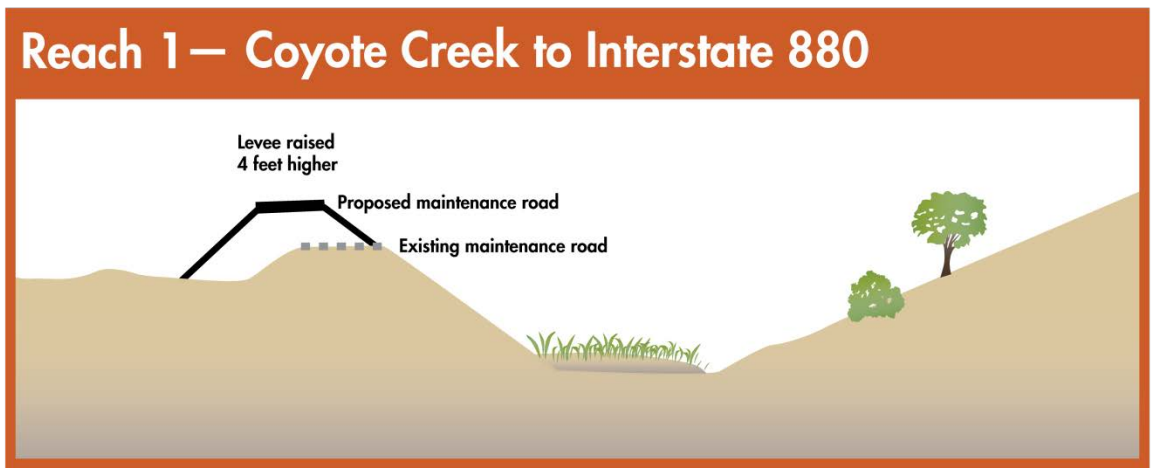
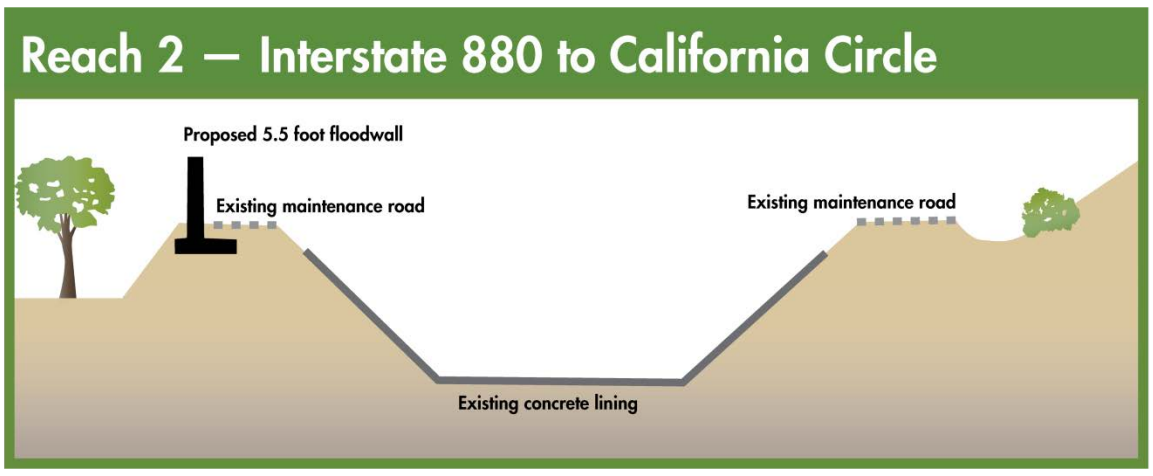
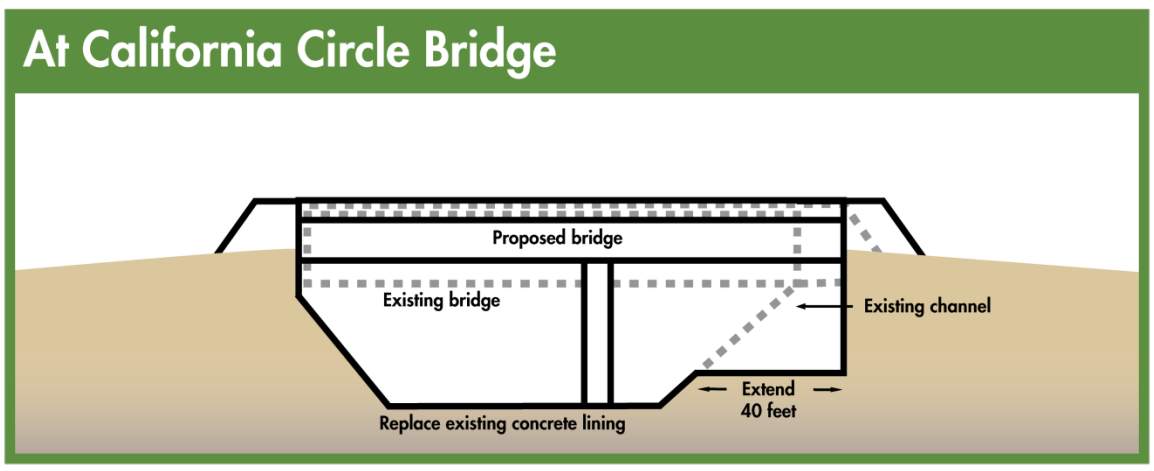
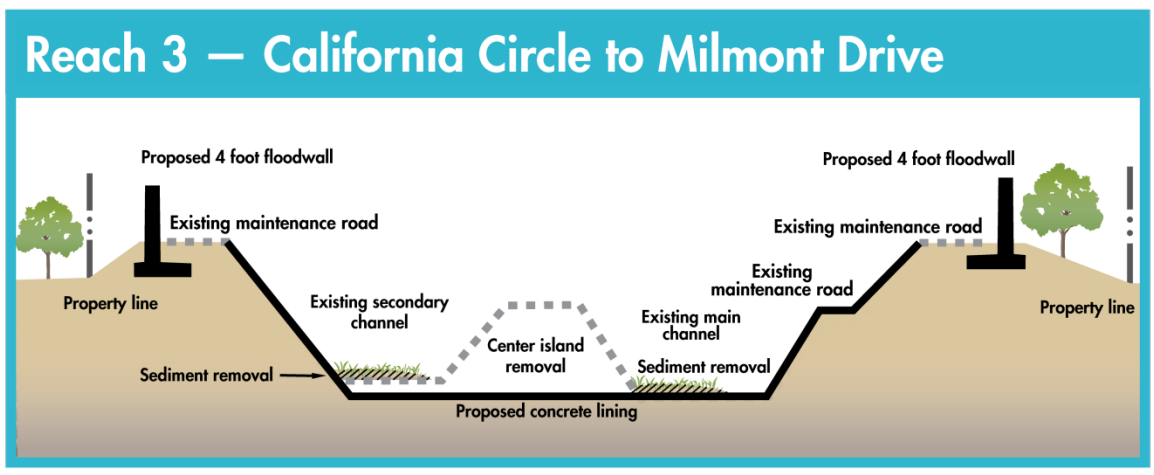
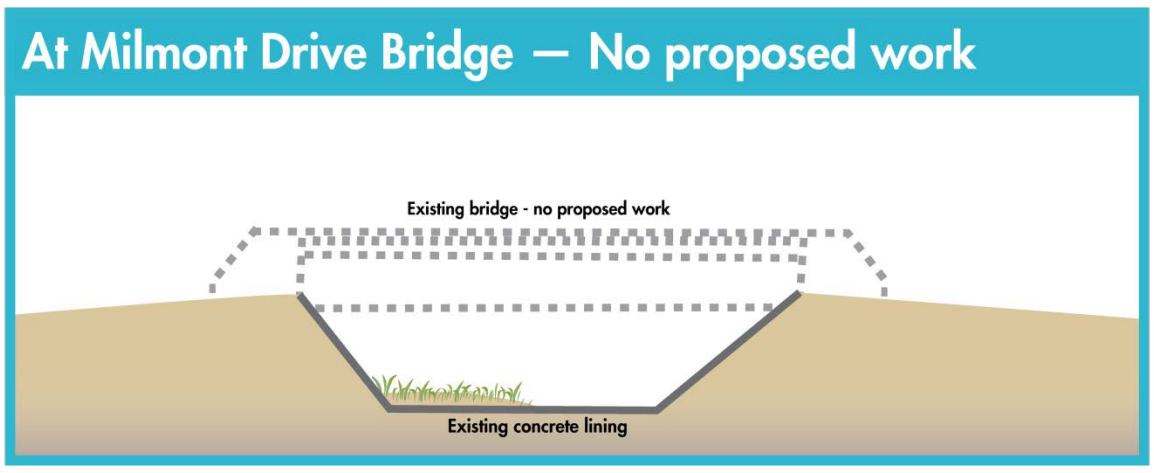
Alternative 6 – Concrete-Lined Channel (Reaches 2–4)
(no sediment allowed)

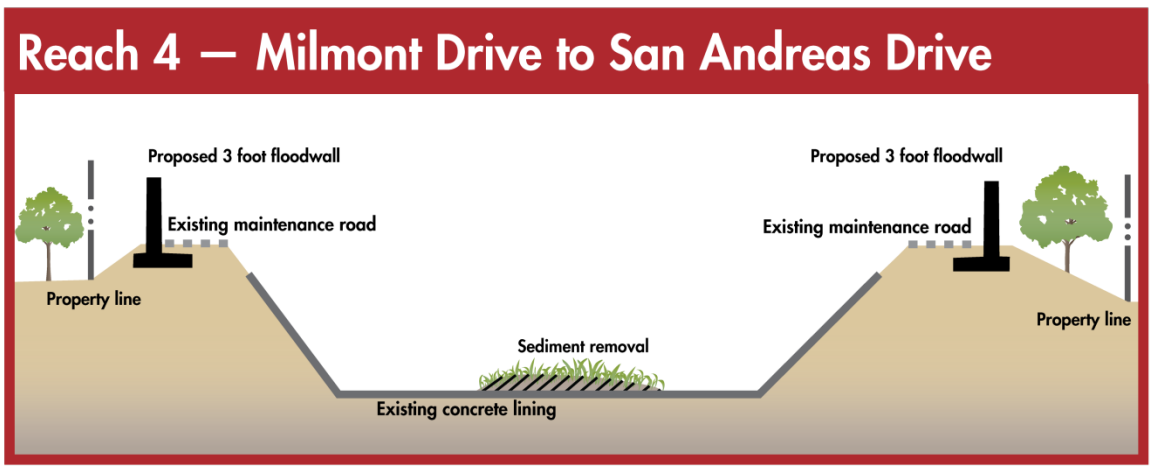












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APPENDIX B

Cost Estimate

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LOWER PENITENCIA CREEK PROJECT--ALTERNATIVE 1: RAISE AND WIDEN CALIFORNIA CIRCLE ONLY

DESCRIPTION Alt #1	QUANTITY	UNIT	UNIT PRICE	AMOUNT
PHASE I - LEVEE & FLOODWALL WORK			(Ref: L Berry)	
CHANNEL EARTH WORK				
Reach 1 (raised ~ 3' existing west levee, L=180')				
Levee embankment fill	940	CY	$ 20.00	$ 18,800.00
Offsite soil disposal (assumed clean soil)	0.00	CY	$ 60.00	$ -
Top Soil - Hydroseeding	32.27	CY	$ 55.00	$ 1,774.85
Reach 2 (40' floodplain on E. side, L=403')				
Channel excavation	3,821	CY	$ 25.00	$ 95,525.00
Clearing & Grubbing	0.30	AC	$ 40,712.70	$ 12,213.81
Offsite soil disposal (assumed clean soil)	3,351	CY	$ 60.00	$ 201,060.00
Top Soil - Hydroseeding	193.60	CY	$ 55.00	$ 10,648.00
Reach 3 (40' flood plain E. side for ~176')				
Channel excavation	1,669	CY	$ 25.00	$ 41,725.00
Offsite soil disposal (assumed clean soil)	1,199	CY	$ 60.00	$ 71,940.00
Reach 4				
N/A				$ -
FLOOD WALLS				
Reach 1				
N/A				$ -
Reach 2 (5' floodwall on W. side)				
Clearing & Grubbing	0.10	AC	$ 40,712.70	$ 4,071.27
Concrete	187	CY	$ 1,600.00	$ 299,200.00
Excavation	693	CY	$ 25.00	$ 17,325.00
Fill	573	CY	$ 20.00	$ 11,460.00
Offsite soil disposal (assumed clean soil)	120	CY	$ 60.00	$ 7,200.00
Top Soil - Hydroseeding	48.40	CY	$ 55.00	$ 2,662.00
Reach 3 (4' floodwall on both sides (L=2881' & L=2705'), w/13.5'				
Clearing & Grubbing	1.36	AC	$ 40,712.70	$ 55,369.27
Concrete	2,722	CY	$ 1,600.00	$ 4,355,200.00
Excavation	10,492	CY	$ 25.00	$ 262,300.00
Fill	8,723	CY	$ 20.00	$ 174,460.00
Offsite soil disposal (assumed clean soil)	1,769	CY	$ 60.00	$ 106,140.00
Top Soil - Hydroseeding	806.67	CY	$ 55.00	$ 44,366.85
Reach 4 (4.5' floodwall on both sides, L=464 each side)				
Clearing & Grubbing	0.30	AC	$ 40,712.70	$ 12,213.81
Concrete	447	CY	$ 1,600.00	$ 715,200.00

LOWER PENITENCIA CREEK PROJECT--ALTERNATIVE 1: RAISE AND WIDEN CALIFORNIA CIRCLE ONLY

DESCRIPTION Alt #1	QUANTITY	UNIT	UNIT PRICE	AMOUNT
Excavation	1,719	CY	$ 25.00	$ 42,975.00
Fill	1,426	CY	$ 20.00	$ 28,520.00
Offsite soil disposal (assumed clean soil)	293	CY	$ 60.00	$ 17,580.00
Top Soil - Hydroseeding	145.20	CY	$ 55.00	$ 7,986.00
Temporary Fencing	9,340	LF	$ 25.00	$ 233,500.00
Subtotal				$ 6,851,415.86
Mobilization (10%)				$ 685,141.59
Subtotal Levee & Floodwall				$ 7,536,557.45
Contingency (20%)				$ 1,507,311.49
Total Construction				**$ 9,043,868.94**
Inspection (15%)				$ 1,356,580.34
Mitigation (5%)				$ 452,193.45
Phase I Levee & Floodwall Total Costs				**$ 10,852,642.73**
PHASE II - BRIDGE WORK		(Ref: D. V Zanen)		
BRIDGE REPLACEMENT				
CA Circle Bridge (132 ft long X 92 ft wide) widened 25' & raised 3'	12,144	LS	$ 315.00	$ 3,825,360.00
(Ref: Bridge replacement estimate provided by Structural Engineering Unit staff. A detailed cost breakdown is available.)				
Subtotal				$ 3,825,360.00
Mobilization (10%)				$ 382,536.00
Subtotal Bridge Items				$ 4,207,896.00
Contingency (20%)				$ 841,579.20
Total Construction				**$ 5,049,475.20**
Inspection (15%)				$ 757,421.28
Mitigation (5%)				$ 252,473.76
Phase II Bridge Work Total Costs				**$ 6,059,370.24**
			TOTAL PHASES I AND II	**$ 16,912,012.97**

LOWER PENITENCIA CREEK PROJECT--ALTERNATIVE 2A: WIDEN BOTH CALIFORNIA CIRCLE AND MILMONT

DESCRIPTION Alt #2A	QUANTITY	UNIT	UNIT PRICE	AMOUNT
PHASE I - LEVEE & FLOODWALL WORK			(Ref: L Berry)	
CHANNEL WIDENING				
Reach 1 (50' floodplain on W. side, L=180')				
Channel excavation	2,089	CY	$ 25.00	$ 52,225.00
Levee &embankment fill	3,687	CY	$ 20.00	$ 73,740.00
Offsite soil disposal (assumed clean soil)	0.00	CY	$ 60.00	$ -
Top Soil - Hydroseeding	32.27	CY	$ 55.00	$ 1,774.85
Reach 2 (40' floodplain on E. side, L=403')				
Channel excavation	3,821	CY	$ 25.00	$ 95,525.00
Clearing & Grubbing	0.30	AC	$ 40,712.70	$ 12,213.81
Offsite soil disposal (assumed clean soil)	3,022	CY	$ 60.00	$ 181,320.00
Top Soil - Hydroseeding	193.60	CY	$ 55.00	$ 10,648.00
Reach 3 (40' flood plain E. side for ~176')				
Channel excavation	1,669	CY	$ 25.00	$ 41,725.00
Offsite soil disposal (assumed clean soil)	870	CY	$ 60.00	$ 52,200.00
Reach 4				
N/A				$ -
FLOOD WALLS				
Reach 1				
N/A				$ -
Reach 2 (5' floodwall on W. side)				
Clearing & Grubbing	0.10	AC	$ 40,712.70	$ 4,071.27
Concrete	187	CY	$ 1,600.00	$ 299,200.00
Excavation	693	CY	$ 25.00	$ 17,325.00
Fill	573	CY	$ 20.00	$ 11,460.00
Offsite soil disposal (assumed clean soil)	120	CY	$ 60.00	$ 7,200.00
Top Soil - Hydroseeding	48.40	CY	$ 55.00	$ 2,662.00
Reach 3 (4' floodwall on both sides (L=2881' & L=2705'), w/13.5'				
Clearing & Grubbing	1.36	AC	$ 40,712.70	$ 55,369.27
Concrete	2,722	CY	$ 1,600.00	$ 4,355,200.00
Excavation	10,492	CY	$ 25.00	$ 262,300.00
Fill	8,723	CY	$ 20.00	$ 174,460.00
Offsite soil disposal (assumed clean soil)	1,769	CY	$ 60.00	$ 106,140.00
Top Soil - Hydroseeding	806.67	CY	$ 55.00	$ 44,366.85
Reach 4 (4.5' floodwall on both sides, L=464 each side)				
Clearing & Grubbing	0.30	AC	$ 40,712.70	$ 12,213.81

LOWER PENITENCIA CREEK PROJECT--ALTERNATIVE 2A: WIDEN BOTH CALIFORNIA CIRCLE AND MILMONT

DESCRIPTION Alt #2A	QUANTITY	UNIT	UNIT PRICE	AMOUNT
Concrete	447	CY	$ 1,600.00	$ 715,200.00
Excavation	1,719	CY	$ 25.00	$ 42,975.00
Fill	1,426	CY	$ 20.00	$ 28,520.00
Offsite soil disposal (assumed clean soil)	293	CY	$ 60.00	$ 17,580.00
Top Soil - Hydroseeding	145.20	CY	$ 55.00	$ 7,986.00
Temporary Fencing	9,340	LF	$ 25.00	$ 233,500.00
Subtotal				$ 6,919,100.86
Mobilization (10%)				$ 691,910.09
Subtotal Levee & Floodwall				$ 7,611,010.95
Contingency (20%)				$ 1,522,202.19
Total Construction				**$ 9,133,213.14**
Inspection (15%)				$ 1,369,981.97
Mitigation (5%)				$ 456,660.66
Phase I Levee & Floodwall Total Costs				**$ 10,959,855.77**
PHASE II - BRIDGE WORK		(Ref: D. V Zanen)		
BRIDGE REPLACEMENT				
CA Circle Bridge (132 ft long X 92 ft wide) widened 25' & raised 3'	12,144	LS	$ 315.00	$ 3,825,360.00
Milmont Bridge (122 ft long X 68 ft wide) widened 35'	8,296	LS	$ 315.00	$ 2,613,240.00
(Ref: Bridge replacement estimate provided by Structural Engineering Unit staff. A detailed cost breakdown is available.)				
Subtotal				$ 6,438,600.00
Mobilization (10%)				$ 643,860.00
Subtotal Bridge Items				$ 7,082,460.00
Contingency (20%)				$ 1,416,492.00
Total Construction				**$ 8,498,952.00**
Inspection (15%)				$ 1,274,842.80
Mitigation (5%)				$ 424,947.60
Phase II Bridge Work Total Costs				**$ 10,198,742.40**
			TOTAL PHASES I AND II	**$ 21,158,598.17**

LOWER PENITENCIA CREEK PROJECT--ALTERNATIVE 4: WIDEN CALIFORNIA CIRCLE AND RAISE MILMONT

DESCRIPTION Alt #4	QUANTITY	UNIT	UNIT PRICE	AMOUNT
PHASE I - LEVEE & FLOODWALL WORK			(Ref: L Berry)	
CHANNEL WIDENING				
Reach 1 (50' floodplain on W. side, L=180')				
Channel excavation	2,089	CY	$ 25.00	$ 52,225.00
Levee &embankment fill	3,687	CY	$ 20.00	$ 73,740.00
Offsite soil disposal (assumed clean soil)	0.00	CY	$ 60.00	$ -
Top Soil - Hydroseeding	32.27	CY	$ 55.00	$ 1,774.85
Reach 2 (40' floodplain on E. side, L=403')				
Channel excavation	3,821	CY	$ 25.00	$ 95,525.00
Clearing & Grubbing	0.30	AC	$ 40,712.70	$ 12,213.81
Offsite soil disposal (assumed clean soil)	3,022	CY	$ 60.00	$ 181,320.00
Reach 3 (40' flood plain E. side for ~176', w.side 40' flood plain				
Channel excavation	32,600	CY	$ 25.00	$ 815,000.00
Offsite soil disposal (assumed clean soil)	31,801	CY	$ 60.00	$ 1,908,060.00
Reach 4				
N/A				$ -
FLOOD WALLS				
Reach 1				
N/A				$ -
Reach 2 (5' floodwall on W. side)				
Clearing & Grubbing	0.10	AC	$ 40,712.70	$ 4,071.27
Concrete	187	CY	$ 1,600.00	$ 299,200.00
Excavation	693	CY	$ 25.00	$ 17,325.00
Fill	573	CY	$ 20.00	$ 11,460.00
Offsite soil disposal (assumed clean soil)	120	CY	$ 60.00	$ 7,200.00
Top Soil - Hydroseeding	48.40	CY	$ 55.00	$ 2,662.00
Reach 3 (4' floodwall on E. bank, 13.5'wall on the E.side for ~176'				
Clearing & Grubbing	1.36	AC	$ 40,712.70	$ 55,369.27
Concrete	5,837	CY	$ 1,600.00	$ 9,339,200.00
Excavation	23,295	CY	$ 25.00	$ 582,375.00
Fill	19,926	CY	$ 20.00	$ 398,520.00
Offsite soil disposal (assumed clean soil)	3,369	CY	$ 60.00	$ 202,140.00
Top Soil - Hydroseeding	806.67	CY	$ 55.00	$ 44,366.85
Reach 4 (4.5' floodwall on both sides, L=464 each side)				
Clearing & Grubbing	0.30	AC	$ 40,712.70	$ 12,213.81
Concrete	447	CY	$ 1,600.00	$ 715,200.00

LOWER PENITENCIA CREEK PROJECT--ALTERNATIVE 4: WIDEN CALIFORNIA CIRCLE AND RAISE MILMONT

DESCRIPTION Alt #4	QUANTITY	UNIT	UNIT PRICE	AMOUNT
Excavation	1,719	CY	$ 25.00	$ 42,975.00
Fill	1,426	CY	$ 20.00	$ 28,520.00
Offsite soil disposal (assumed clean soil)	293	CY	$ 60.00	$ 17,580.00
Top Soil - Hydroseeding	145.20	CY	$ 55.00	$ 7,986.00
Temporary Fencing	9,340	LF	$ 25.00	$ 233,500.00
Subtotal				$ 15,161,722.86
Mobilization (10%)				$ 1,516,172.29
Subtotal Levee & Floodwall				$ 16,677,895.15
Contingency (20%)				$ 3,335,579.03
Total Construction				**$ 20,013,474.18**
Inspection (15%)				$ 3,002,021.13
Mitigation (5%)				$ 1,000,673.71
Phase I Levee & Floodwall Total Costs				**$ 24,016,169.01**
PHASE II - BRIDGE WORK			(Ref: D. V Zanen)	
BRIDGE REPLACEMENT (CA Cir Bridge not raised for this Alternativ				
CA Circle Bridge (132 ft long X 92 ft wide) widened 25'	12,144	LS	$ 315.00	$ 3,825,360.00
Milmont Bridge (122 ft long X 68 ft wide) raised 3'	8,296	LS	$ 315.00	$ 2,613,240.00
(Ref: Bridge replacement estimate provided by Structural Engineering Unit staff. A detailed cost breakdown is available.)				
Subtotal				$ 6,438,600.00
Mobilization (10%)				$ 643,860.00
Subtotal Bridge Items				$ 7,082,460.00
Contingency (20%)				$ 1,416,492.00
Total Construction				**$ 8,498,952.00**
Inspection (15%)				$ 1,274,842.80
Mitigation (5%)				$ 424,947.60
Phase II Bridge Work Total Costs				**$ 10,198,742.40**
			TOTAL PHASES I AND II	**$ 34,214,911.41**

LOWER PENITENCIA CREEK PROJECT--ALTERNATIVE 6: CONCRETE CHANNEL

DESCRIPTION Alt #6	QUANTITY	UNIT	UNIT PRICE	AMOUNT
PHASE I - LEVEE & FLOODWALL WORK			(Ref: L Berry)	
CHANNEL EARTH WORK				
Reach 1 (raised ~ 3' existing west levee, L=180')				
Levee embankment fill	940	CY	$ 20.00	$ 18,800.00
Offsite soil disposal (assumed clean soil)	0.00	CY	$ 60.00	$ -
Top Soil - Hydroseeding	32.27	CY	$ 55.00	$ 1,774.85
Reach 2 (n/a besides R1, all reaches are concrete channel)				
Channel excavation	0.00	CY	$ 25.00	$ -
Offsite soil disposal (assumed clean soil)	0.00	CY	$ 60.00	$ -
Top Soil - Hydroseeding	0.00	CY	$ 55.00	$ -
Reach 3 (n/a besides R1, all reaches are concrete channel)				
Channel excavation	0.00	CY	$ 25.00	$ -
Offsite soil disposal (assumed clean soil)	0.00	CY	$ 60.00	$ -
Top Soil - Hydroseeding	0.00	CY	$ 55.00	$ -
Reach 4				
N/A				$ -
TRAPEZOIDAL CONCRETE CHANNEL				
Reach 1				
N/A				$ -
Reach 2 (18.5'H @ 1:1 slope both sides; 50' W; 18" thickness)				
Concrete (21'+50'+21' x 18" x 403'L = 2060)	2,060	CY	$ 1,600.00	$ 3,296,000.00
Reach 3				
Concrete (21'+50'+21' x 18" x 2880'L = 14720)	14,720	CY	$ 1,600.00	$ 23,552,000.00
Reach 4				
Concrete (21'+50'+21' x 18" x 464'L = 2375)	2,375	CY	$ 1,600.00	$ 3,800,000.00
Temporary Fencing	9,340	LF	$ 25.00	$ 233,500.00
Subtotal				$ 30,902,074.85
Mobilization (10%)				$ 3,090,207.49
Subtotal Levee & Floodwall				$ 33,992,282.34
Contingency (20%)				$ 6,798,456.47
Total Construction				**$ 40,790,738.80**
Inspection (15%)				$ 6,118,610.82
Mitigation (5%)				$ 2,039,536.94
Phase I Levee & Floodwall Total Costs				**$ 48,948,886.56**

LOWER PENITENCIA CREEK PROJECT--ALTERNATIVE 6: CONCRETE CHANNEL

DESCRIPTION Alt #6	QUANTITY	UNIT	UNIT PRICE	AMOUNT
PHASE II - BRIDGE WORK			(Ref: D. V Zanen)	
BRIDGE REPLACEMENT				
CA Circle Bridge (132 ft long X 92 ft wide) widened 25' & raised 3'	12,144	LS	$ 315.00	$ 3,825,360.00
(Ref: Bridge replacement estimate provided by Structural Engineering Unit staff. A detailed cost breakdown is available.)				
Subtotal				$ 3,825,360.00
Mobilization (10%)				$ 382,536.00
Subtotal Bridge Items				$ 4,207,896.00
Contingency (20%)				$ 841,579.20
Total Construction				**$ 5,049,475.20**
Inspection (15%)				$ 757,421.28
Mitigation (5%)				$ 252,473.76
Phase II Bridge Work Total Costs				**$ 6,059,370.24**
			TOTAL PHASES I AND II	**$ 55,008,256.80**

APPENDIX C

Natural Flood Protection Evaluation

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Lower Penitencia Creek Improvements Project
Natural Flood Protection (NFP) Evaluation

The criteria are scored as follows:

5 = Outstanding
4 = Very good
3 = Adequate
2 = Fair
1 = Poor
0 = Unacceptable

TABLE 1: NFP Objectives and Subject Matter Experts	
NFP Objective	**SME**
1. Homes, Schools, Businesses and Transportation Networks are Protected from Flooding and Erosion	Pari Gharib
2. Integrate Within the Context of the Watershed	James Manitakos
3. Support Ecological Functions and Processes	Matt Parsons
4. Integrate Physical Geomorphic Stream Functions and Processes	Liang Xu
5. Minimize Maintenance Requirements	Devin Mody, Mark Wander, Roy Weese
6. Protect the Quality and Availability of Water	Brett Calhoun
7. Cooperate with Other Local Agencies to Achieve Mutually Beneficial Goals	Sam Yung, James Manitakos
8. Maximize Community Benefits Beyond Flood Protection	James Manitakos
9. Minimize Life-Cycle Costs	Christy Chung
10. Impacts are Avoided, Minimized, or Mitigated	Kurt Lueneburger, James Manitakos

Objective 1—Homes, Schools, Businesses and Transportation Networks are Protected from Flooding and Erosion (High Weight)

Criterion C1.1: Safety (30)

Rating Guidance: Assesses protection of public safety if conditions exceed design assumptions.

Outstanding: Alternative continues to provide for public safety when flows exceed design flow or if design assumptions prove inaccurate.

Adequate: Alternative improves safety compared to existing conditions when flows exceed the design flow or if design assumptions prove inaccurate.

Poor: Alternative provides safety only up to design flow.

Unacceptable: Overall, flood hazard is increased.

Alternative	Rating	# Score	Comments
No project	Unacceptable	0	Future increase in flows from upstream not accommodated.
1	Fair	2	Milmont Drive bridge is under pressure flow
2A	Adequate	3	Capacity meets but does not significantly exceed design flow.
4	Adequate	3	Capacity meets but does not significantly exceed design flow.
6	Adequate	3	Capacity meets but does not significantly exceed design flow.

Objective 1— Homes, Schools, Businesses and Transportation Networks are Protected from Flooding and Erosion (High Weight)

Criterion C1.2: Economic Protection (30)

Rating guidance: Assesses protection from damage due to floodwater, erosion, or sediment.

Outstanding: Exceeds FEMA certification standards.

Adequate: Meets FEMA certification standards.

Poor: Design flows are not contained within project area, but would not cause substantial damage ('nuisance flows' of less than one foot).

Unacceptable: Flows less than the design flows would likely cause substantial damage to in-stream features, including bed and banks.

Alternative	Rating	# Score	Comments
No project	Unacceptable	0	Design flow exceeds existing flow conveyance capacity
1	Adequate	3	Meets required WSEL, Meets FEMA certification stds
2A	Adequate	3	Meets required WSEL, Meets FEMA certification stds
4	Adequate	3	Meets required WSEL, Meets FEMA certification stds
6	Very good	4	1% flow WSEL is over 1 ft below required WSEL, Meets FEMA certification stds

Objective 1— Homes, Schools, Businesses and Transportation Networks are Protected from Flooding and Erosion (High Weight)

Criterion C1.3: Durability (10)

Rating guidance: Assesses future District effort required to maintain design level of protection

Outstanding: Level of protection is virtually independent of future actions:
a) Designed to be virtually maintenance-free.
b) Has a viable, easily permittable, practical Operation and Maintenance Plan.
c) Protection does not rely on real-time intervention during a flood event.

Adequate: Level of protection is dependent on future actions that can be realistically implemented:
a) Periodic maintenance specified in a defined cycle of 3 or more years between major activities.
b) Operation and Maintenance Plan preserves capacity, but may have some complexity in permitting or implementation.

Poor: Level of protection is dependent on future actions; they would be difficult or costly to apply and sustain:
a) Frequent maintenance specified—less than 3 years between major activities.
b) Operation and Maintenance Plan preserves capacity, but difficult to permit or implement.

Unacceptable: Level of protection is dependent on intense level of future actions requiring extensive knowledge and preparation, making them subject to potential failure.

Alternative	Rating	# Score	Comments
No Project	Poor	1	Requires future improvements to meet design flow
1	Adequate	3	Requires periodic sediment removal in Reaches 2 and 4
2A	Very good	4	Avoids need for future sediment removal
4	Very good	4	Avoids need for future sediment removal
6	Adequate	3	Requires periodic sediment removal in Reaches 2, 3 and 4

Objective 1— Homes, Schools, Businesses and Transportation Networks are Protected from Flooding and Erosion (High Weight)

Criterion C1.4: Resiliency (10)

Rating guidance: Assess adaptability to future changes external to District activities (e.g. future development, vegetation growth)

Outstanding: Channel design would accommodate design flows factoring in future sediment and vegetative conditions.

Adequate: Channel design conveys flows.

Poor: Channel design can convey flows with no sediment accumulation and minimal vegetation growth.

Unacceptable: Channel design does not convey flows.

Alternative	Rating	# Score	Comments
No project	Unaccepatable	0	Design flow exceeds existing flow conveyance capacity
1	Fair	2	Channel conveys design flow but will require periodic sediment removal in Reaches 2 and 4
2A	Very Good	4	Channel flow capacity can be increased with periodic sediment removal
4	Very Good	4	Channel flow capacity can be increased with periodic sediment removal
6	Fair	2	Channel conveys design flow but will require periodic sediment removal in Reaches 2, 3 and 4

Objective 1— Homes, Schools, Businesses and Transportation Networks are Protected from Flooding and Erosion (High Weight)

Criterion C1.5: Local Drainage (10)

Rating guidance: Assesses support of local drainage systems

Outstanding: Alternative design improves local drainage in storm sewers.

Adequate: Alternative accommodates existing local drainage inputs without causing temporary street flooding. Alternative does not exacerbate any existing problems with storm-drains and localized street-flooding.

Poor: Alternative accommodates local drainage, but may retard flows to creeks during high flow events, causing temporary "nuisance flooding" in local streets.

Unacceptable: alternative does not accommodate local drainage systems.

Alternative	Rating	# Score	Comments
No Project	Poor	1	Overtopping of banks will retard local storm drainage
1	Adequate	3	Accommodates local storm drainage but no improvement
2A			
4			
6			

Objective 1— Homes, Schools, Businesses and Transportation Networks are Protected from Flooding and Erosion (High Weight)

CriterionC1. 6: Time to Implementation (10)

Rating guidance: Assess time to implement.

Outstanding: Least amount of time to implement compared to other alternatives.

Adequate: Time to implementation is approximately equal with most other alternatives.

Poor: Longest amount of time to implement compared to other alternatives.

Unacceptable: Indefinite time to implement due to funding, regulatory restrictions or other complications.

Alternative	Rating	# Score	Comments
No project	Outstanding	5	Already implemented
1	Very Good	4	Only one bridge modified
2A	Fair	2	Two bridges modified and low floodwalls
4	Poor	1	Two bridges modified and tall floodwall in Reach 3
6	Adequate	3	Only one bridge modified, but considerable concrete work

Objective 2—Integrate Within the Context of the Watershed (High Weight)

Criterion C2.1: Meets Local Watershed Goals (100)

Rating guidance: Assesses ability to meet watershed goals as defined in a process that examines the watershed as a whole and accounts for opportunities and constraints specific to the project area.
Outstanding: The alternative substantially advances watershed goals.
Adequate: The alternative advances some watershed goals, and is not in conflict with any watershed **Goals.**

Poor: The alternative conflicts with more than one major watershed goal.
Unacceptable: The project is in conflict with a number of watershed goals,
OR
Watershed goals have not been created.

NOTE: Watershed goals have not been created; therefore, relevant policies and goals from the City of Milpitas General Plan are used for this evaluation.

Alternative	Rating	# Score	Comments
No project	Poor	1	Thei alternative does not meet Policy 5.b.I-5.
1	Very Good	4	This alternative meets the following City of Milpitas Goals and Policies: • 4.a G-2: Develop diversified trail system along streamsides and other public right of ways to provide recreational opportunities and link facilities • 4.d G-1: Assure reasonable protection of beneficial uses of creeks and protect environmentally sensitive areas • 5.b G-1: Minimize threat to life and property from flooding 5.b I-5: Seek construction of flood control channel to withstand 100-year flood along Penitencia Creek. It supports east and west bank trails.
2A	Very Good	4	This meets City policies and goals 4a G-2, 5.b G-1, and 5.b I-5. It exceeds goal 4.d G-1 by increasing the amount of creekside vegetated area in Reaches 1 and 2. It supports east and west bank trails.
4	Adequate	3	This meets City policies and goals 4a G-2, 5.b G-1, and 5.b I-5. It greatly exceeds goal 4.d G-1 by greatly increasing the amount of creek-side vegetated area in Reaches 1, 2 and 3. The west bank trail would be of low quality due to its location on a depressed channel access road.
6	Poor	1	This alternative reduces wetlands and riparian habitat and does not meet City Goal 4.d. G-1. This alternative meets

			City Goal 4.d G-2 and Policy 5.b. I-5. City Goal 4.a G-2 is nominally met because the east bank trail would be retained, but the quality of the recreational experience would be adversely affected by a mostly concrete creek channel.

Objective 3—Support Ecologic Functions and Processes (Medium Weight)

Criterion C3.1: Meets Local Habitat Goals (25)

Rating guidance: Assess ability to meet habitat goals as defined from examining the watershed as a whole and accounting for opportunities and constraints specific to the project area.

Outstanding: The alternative meets or exceeds local habitat goals.

Adequate: The alternative meets some local habitat goals, and is not in conflict with any habitat goals.

Poor: The alternative may conflict with one or more habitat goals.

Unacceptable: The alternative is in conflict with a number of habitat goals established as described above.
OR
Habitat goals have not been created.

NOTE: Local habitat goals have not been created, however the Basin Plan adopted by the RWQCB lists warm freshwater habitat and wildlife habitat as beneficial uses of Lower Penitencia Creek.

Alternative	Rating	# Score	Comments
No project	Poor	1	No increase in vegetated area and requires future periodic sediment removal that would disrupt habitat
1	Fair	2	This alternative would result in only a minor increase in vegetated area and would require future periodic sediment removal that would disrupt habitat.
2A	Very Good	4	This alternative would preserve existing habitat and add new freshwater and wildlife habitat in Reaches 1 and 2. Future disruption of habitat during periodic sediment removal would be prevented.
4	Outstanding	5	This alternative would preserve existing habitat and add new freshwater and wildlife habitat in Reaches 1, 2 and 3. A large amount of freshwater and wildlife habitat would be added in Reach 3. Future disruption of habitat during periodic sediment removal would be prevented.
6	Unacceptable	0	Existing freshwater and wildlife habitat in Reach 3 would be permanently removed,

Objective 3—Support Ecologic Functions and Processes (Medium Weight)

Criterion C3.2: Quality of Habitat (30)

Rating guidance: Assesses quality of habitat provided by the project area.

Outstanding: The alternative would provide relatively undisturbed habitat composed of native plant species and features with a high potential to meet the needs (such as feeding, breeding, resting, movement, cover) for an appropriate and locally native assemblage of fish, amphibians, reptiles, birds, mammals and invertebrates in each phase of their life-cycle. Alternative addresses the special needs of endemic, endangered or special status species.

Adequate: The alternative would support the needs for a locally appropriate assemblage of fish, amphibians, reptiles, birds, mammals and invertebrates in each phase of their life-cycle. Alternative addresses the special needs of endemic, endangered or special status species.

Poor: Alternative focuses primarily on the special needs of threatened and endangered species as required by appropriate regulatory agencies.

Unacceptable: The alternative does not provide any habitat value, consists of paved areas or areas with no vegetation.

Alternative	Rating	# Score	Comments
No project	Poor	1	No improvement over current condition.
1	Fair	2	Marginal improvement over current condition due to creation of vegetated bench in Reach 2.
2A	Very Good	4	Substantial improvement over current condition due to creation of vegetated benches in Reaches 1 and 2.
4	Outstanding	5	Creation of vegetated benches in reaches 1, 2, and 3. Represent greatest improvement over existing conditions of any alternative. Reach 3 bench is very large.
6	Unacceptable	0	Removal of substantial vegetation in Reaches 2 and 3 with no replacement.

Objective 3—Support Ecologic Functions and Processes (Medium Weight)

Criterion C3.3: Sustainability of Habitat (25)

Rating guidance: Assesses intensity of future human intervention required to maintain the target habitat quality; opportunity for habitat to self-adjust appropriately to future change.

Outstanding: All of the following apply to alternative:
a) Channel maintenance for capacity is projected to be minimal, allowing vegetation to develop, age and change naturally.
b) Channel banks will be dynamically stable in the long-term.
c) Vegetative maintenance / intervention has been minimized.
d) Vegetation expected to be self-sustaining with appropriate successional changes.
Adequate: All of:
a) Channel capacity maintenance would require periodic selective thinning of vegetation.
b) Same as "b" above.
c) Some short-term intervention (i.e. 'landscaping') necessary (up to five years) to establish vegetation.
d) Same as "d" above.
Poor: All of:
a) Regular maintenance for channel capacity is anticipated, compromising vegetation's ability to develop, age and change naturally.
b) Channel bank is expected to remain stable overall, with potential areas of instability that would require periodic rehabilitation.
c) Intervention (i.e. 'landscaping') necessary to maintain vegetation over long-term.
d) vegetation is self-perpetuating without appropriate successional changes
Unacceptable:
a) Regular maintenance for channel capacity is anticipated, likely requiring major removal of vegetation.
b) Unstable channel banks (erosion, deposition). Cross sectional instability expected over time.
c) Frequent maintenance / irrigation of vegetation is necessary for vegetative survival (often indicating an inappropriate match of vegetation to soil/water conditions).
d) Due to maintenance or instability, vegetation is not expected to be self-sustaining.

Alternative	Rating	# Score	Comments
No project	Poor	1	No change from existing condition. Frequent sediment removal in future.
1	Poor	1	Little change from existing condition. Frequent sediment removal in future.
2A	Adequate	3	Vegetated benches in Reaches 1 and 2 should be self-supporting. Minimal need for future sediment removal, but woody vegetation would be removed.
4	Very good	4	Vegetated benches in Reaches 1 , 2, and 3 should be self-supporting. Minimal need for future sediment removal, but woody vegetation would be removed.
6	Poor	1	Replaces vegetation with concrete in Reaches 2, 3, and 4. Frequent sediment removal in future.

Objective 3—Support Ecologic Functions and Processes (Medium Weight)

Criterion C3.4: Connectivity of Habitat (20)

Rating guidance: Assesses integration of habitat elements into surrounding habitat landscape and within the project area.

Outstanding: Alternative provides a continuous riparian corridor along the length of the project and is appropriately integrated into the surrounding habitat mosaic.

Adequate: Alternative provides a contiguous, wildlife-accessible corridor connected to surrounding habitat mosaic, with much of the riparian corridor biologically intact.

Poor: Alternative does not provide contiguous riparian wildlife corridor and is not connected to surrounding habitat mosaic.

Unacceptable: Alternative not integrated into surrounding habitat.

Alternative	Rating	# Score	Comments
No project	Fair	2	Reach 1 vegetated area connect to downstream habitat, but little or no habitat connectivity in Reaches 2, 3 and 4.
1	Adequate	3	Reach 1 and 2 vegetated areas connect to downstream habitat, but little or no habitat connectivity to Reaches 3 and 4
2A	Very Good	4	Creation of vegetated benches in Reaches 1 and 2 and retention of existing vegetated island in Reach 3 result in connected habitat in the project area. Also connection to downstream habitat abutting coyote Creek.
4	Outstanding	5	Creation of vegetated benches in Reaches 1, 2, and 3 and retention of existing vegetated island in Reach 3 result in connected habitat in the project area. Reach 3 vegetated bench is large and connects to low-flow channel and downstream habitat. Also connection to downstream habitat abutting coyote Creek.
6	Poor	1	Mostly concrete with isolated patches of vegetation.

Objective 4—Integrate Physical Geomorphic Stream Functions and Processes (Medium Weight)

Criterion C4.1: Floodplain (30)

Rating guidance: Inclusion of an appropriately sized overflow area (adjacent floodplain) within the flood conveyance corridor that conveys high flows and dissipates erosive energy.

Outstanding: Active channel is hydraulically connected to a floodplain at properly sized bankfull level.

Adequate: Modified floodplain: Multi-stage channel (a smaller channel within a larger channel) allows expansion of flows higher than approximately ¼ to 1/3 of the design flow by providing additional flow area (modified floodplain); but limited right-of-way requires that setback levees or other containment means are necessary.

Poor: Flow will not spread out laterally (overflow onto floodplain or second-phase channel) until at least ½ of design flow (e.g. 1%) is reached.

Unacceptable: Single-phase channel (no separate active channel, no floodplain of any size) sized to convey 1% flow.

Alternative	Rating	# Score	Comments
No project	Fair	2	No improvement from current condition.
1	Fair	2	No improvement from current condition.
2A	Very Good	4	Expands vegetated tidal bench in Reach 2 serves as floodplain and preserves existing bifurcated channel and island in Reach 3.
4	Outstanding	5	Expanded vegetated tidal benches in Reaches 2 and 3 serve as floodplain.
6	Poor	1	Concrete-lined channel lacks floodplain or benches.

Objective 4— Integrate Physical Geomorphic Stream Functions and Processes (Medium Weight) (Medium Weight)

Criterion C4.2: Active Channel (30)

Rating guidance: Assesses appropriateness of size and configuration of the active channel relative to watershed inputs and reach characteristics.

Outstanding: Tidal processes are fully accounted for, including range of tidal prism flows and tidal sedimentation processes.

Adequate: For extremely limited right-of-way, hardscaped near-vertical walls are used to maximize plan form space for flowage, active channel meander and near-stream vegetation. In highly confined creeks, large roughness elements (boulders, logs) used to force pool/bar development if appropriate (see Montgomery Buffington 1997)

Poor: Active channel is incorporated into the plan, but due to lack of data or significant site constraints, it is unknown whether it will be fully functioning in its ability to convey the dominant hydraulic and sediment discharge.

Unacceptable: No separate active channel is incorporated into alternative plan.

Alternative	Rating	# Score	Comments
No project	Fair	2	No improvement from current condition.
1	Fair	2	No improvement from current condition.
2A	Very Good	4	Expands vegetated tidal bench in Reach 2 and preserves existing bifurcated channel and island in Reach 3.
4	Outstanding	5	Expanded vegetated tidal benches in Reaches 2 and 3 define low-flow channel.
6	Poor	1	Concrete-lined channel is trapezoidal and lacks geomorphic elements.

Objective 4— Integrate Physical Geomorphic Stream Functions and Processes (Medium Weight) (Medium Weight)

Criterion C4.3: Stable Side Slopes (20)

Rating guidance: Assesses stability of side slopes using geotechnical or biotechnical methods.

Outstanding: All channel side slopes are stable through use of proper side slope ratios appropriate to the geologic materials and expected detrimental forces including hydraulic shear, gravity, overland flow, etc.

Adequate: Side slopes are protected from instability through biotechnical means (e.g. log crib walls with willows, root wads, willow wattles).

Poor: Side slopes are protected using hardscape (vegetated hardscape—e.g. planted rip-rap would earn a "fair" rating).

Unacceptable: Channel side slopes (either active channel or conveyance channel) are unstable and unprotected and subject to failure from anticipated adversary forces.

Alternative	Rating	# Score	Comments
No project	1	Poor	Minimal change from existing condition.
1	1	Poor	Minimal change from existing condition. Hardscape reduced in Reach 2.
2A	4	Very good	Slopes in most reaches are stabilized through combination of sloping and vegetation
4	3	Adequate	Slopes in most reaches are stabilized through combination of sloping and vegetation; however Reach 3 west bank slope is concrete floodwall
6	1	Poor	Hardscape used to protect slopes throughout

Objective 4— Integrate Physical Geomorphic Stream Functions and Processes (Medium Weight) (Medium Weight)

Criterion C4.4: Upstream/Downstream Transitions (25)

Rating guidance: Assesses stability of channel's integration with upstream and downstream reaches.

Outstanding: Channel bottom is integrated so that it transitions seamlessly with stable upstream and downstream reaches. Transitions are achieved without abrupt changes in grade or direction of flow.

Adequate: Transition to upstream and/or downstream elevations require a stabilizing grade control. Grade control structures are limited to around 18 inch drop and minimally hardscaped (e.g. rock weirs).

Poor: Existing infrastructure at upstream and/or downstream ends require a hardscaped grade control structure with a drop greater than about 18 inch.

Unacceptable: Reaches upstream and/or downstream of the project are unstable and transitions between project reach and adjacent reach(es) are not designed for long-term stability.

Alternative	Rating	# Score	Comments
No project	3	Adequate	Transitions are primarily concrete lined beds and banks.
1	3	Adequate	Transitions are primarily concrete lined beds and banks.
2A	4	Very good	Vegetated tidal bench in Reach 2 provides improved transition.
4	4	Very good	Vegetated tidal benches in Reaches 2 and 3 provide improved transitions.
6	3	Adequate	Transitions are primarily concrete lined beds and banks.

Objective 5—Minimize Maintenance Requirements (High Weight)

Criterion C5.1: Structural Features (25)

Rating guidance: Assesses maintenance requirements associated with structural features within project corridor.

Outstanding: Need for structural features that require routine maintenance has been eliminated by design.

Adequate: Need for structural features that require routine maintenance has been reduced compared to existing conditions by design.
OR
Design of required structural features accounts for and minimizes projected routine maintenance.

Poor: Maintenance required for structural features is roughly equivalent to existing conditions.

Unacceptable: Significant numbers of structural features, requiring routine maintenance are incorporated into design.
AND/OR
More structural features than under existing conditions.

Alternative	Rating	# Score	Comments
No project	Poor	1	Maintenance unchanged from existing conditions.
1	Unacceptable	0	New structural features include: • widened California Circle Bridge, • raised levee in Reach 1, and • concrete floodwalls in reaches 2, 3, and 4.
2A	Unacceptable	0	New structural features include: • widened California Circle and Milmont Drive bridges, • raised levee in Reach 1, and • concrete floodwalls in reaches 2, 3, and 4.
4	Unacceptable	0	New structural features include: • widened California Circle and Milmont Drive bridges, • raised levee in Reach 1, and • concrete floodwalls in reaches 2, 3, and 4.
6	Unacceptable	0	New structural features include: • widened California Circle Bridge, • raised levee in Reach 1, • concrete floodwalls in Reaches 2, 3, and 4, and • concrete lining in Reaches 3.

Objective 5 – Minimize Maintenance Requirements (High Weight)

Criterion C5.2: Natural Processes (25)

Rating guidance: Assesses maintenance requirements associated with vegetation growth, erosion and sediment processes

Outstanding: a) Expected (modeled) sediment deposition and vegetative growth for 100 plus years will not cause flows to exceed the design capacity including appropriate freeboard.
b) Stream bank erosion requiring repairs is not expected.
c) Conveyance channel incorporates floodplain area to minimize erosive velocities.

Adequate: a) Expected (modeled) sediment deposition and vegetative growth for 10 plus years will not cause flows to exceed the 1 percent capacity.
b) Some erosion is expected, but emergency erosion repairs will not be necessary.
c) Channel incorporates multi-phase channel design or bypass to alleviate high velocity, erosive flows in the main conveyance channel.

Poor: a) Expected (modeled or estimated) maintenance cycle for capacity restoration for sediment or vegetation in any one area is three or less years.
b) Maintenance guidelines provided so that locations of sediment maintenance are known, although frequency is not.
c) Alternative incorporates few if any areas where high flows are able to spread out and reduce velocities/erosive forces.

Unacceptable: a) Sediment, erosion potential and vegetation growth not modeled or otherwise accounted for.
b) Yearly maintenance expected or probable.
c) Channel is single-phase with no floodplain or secondary channel to relieve high flow pressure.

Alternative	Rating	# Score	Comments
No project	Poor	1	Future periodic sediment removal in Reaches 2 and 4.
1	Poor	1	Future periodic sediment removal in Reaches 2 and 4.
2A	Very Good	4	Minimizes needs for future sediment removal and Reach 2 bench will minimize flow velocities. Vegetated benches in Reaches 2 and 3 reduce flow velocities.
4	Outstanding	5	Vegetated benches in Reaches 2 and 3 reduce flow velocities.
6	Poor	1	Future periodic sediment removal in Reaches 2, 3 and 4.

Objective 5—Minimize Maintenance Requirements (High Weight)

Criterion C5.3: Urban Flows (25)

Rating guidance: Assesses maintenance requirements resulting from smaller, high-frequency storm events and outfall flows

Outstanding: Maintenance requirements from urban flows would be significantly reduced.

Adequate: Maintenance requirements from urban flows would be somewhat reduced.

Poor: Maintenance requirements from urban flows would be about the same or worse.

Unacceptable: Outfalls will contribute to excessive erosion and sedimentation in the channel. For example, high-output outfalls are placed at right angles to bank and flow directly into channel with no transition zone between outfall and creek flow.

Alternative	Rating	# Score	Comments
No project	Poor	1	No change from existing condition.
1	Poor	1	No change from existing condition.
2A	Poor	1	No change from existing condition.
4	Poor	1	No change from existing condition.
6	Poor	1	No change from existing condition.

Objective 5—Minimize Maintenance Requirements (High Weight)

Criterion C5.4: Access(25)

Rating guidance: Assesses incorporation of adequate access for maintenance crews and equipment.

Outstanding: Alternative provides multiple function access corridors and access points, optimized based on an analysis of projected maintenance activities and required maintenance equipment. For example, one extra-wide road might provide equipment access superior to two standard-width roads.

Adequate: Access corridors comply with District policy 3-410 of Engineering Policies & Procedures

Poor: Access corridors are provided, but do not comply with District policy 3-410 of Engineering Policies & Procedures,

Unacceptable: Alternative provides inadequate or no access for maintenance crews and equipment.

Alternative	Rating	# Score	Comments
No project	Adequate	3	Retains levee-crest roads in Reaches 1, 2, 3, and 4 and access ramps in Reaches 2, 3, and 4. Retains center island road in Reach 3.
1	Adequate	3	Provides levee-crest roads in Reaches 1, 2, 3, and 4 and access ramps in Reaches 2, 3, and 4. Retains center island road in Reach 3.
2A	Adequate	3	
4	Adequate	3	
6	Very Good	4	Provides levee-crest roads in Reaches 1, 2, 3, and 4 and access ramps in Reaches 2,3, and 4. Concrete-lined bed in Reaches 1, 2 and 3 facilitates vehicle movement.

Objective 6—Protect the Quality and Availability of Water (Medium Weight)

Criterion C6.1: Water Availability (10)

Rating guidance: Assesses impact on groundwater recharge.

Outstanding: Alternative would result in a net increase in recharge potential (i.e. increased perviousness in SCVWD-mapped recharge zones).

Adequate: No net change in potential recharge for the project area.

Poor: Alternative would reduce the potential for recharge in the project area (i.e. decrease perviousness in SCVWD-mapped recharge zones).

Unacceptable: Alternative substantially reduces or eliminates the existing potential for recharge in the project area.

Alternative	Rating	# Score	Comments
No project	Adequate	3	No change in recharge from existing condition.
1	Adequate	3	No change in recharge from existing condition.
2A	Adequate	3	No change in recharge from existing condition.
4	Adequate	3	No change in recharge from existing condition.
6	Unacceptable	0	Concrete bed lining will prevent creek water from infiltrating and recharging the shallow aquifer.

Objective 6—Protect the Quality and Availability of Water (Medium Weight)

Criterion C6.2 Groundwater Quality (10)

Rating guidance: Assesses groundwater quality protection from contamination and the threat of contamination by preventing contamination entry into groundwater.

Outstanding: Alternative maintains the minimum required separation for natural protection of groundwater and contains elements that provide structural features with ongoing maintenance to prevent contaminant entry into groundwater.

Adequate: Alternative maintains the minimum required separation for natural protection of groundwater. Alternative contains elements that provide structural features with ongoing maintenance to prevent contaminant entry into groundwater; and incorporate best management practices (e.g., vegetated swales) with ongoing maintenance

Poor: Alternative does not maintain the minimum required separation for natural protection of groundwater, however alternative includes best management practices with ongoing maintenance.

Unacceptable: Alternative does not maintain the minimum required separation for natural protection of groundwater and does not include measures or programs to protect groundwater quality.

Alternative	Rating	# Score	Comments
No project	Adequate	3	No change from existing condition.
1	Adequate	3	No change from existing condition.
2A	Adequate	3	No change from existing condition.
4	Adequate	3	No change from existing condition.
6	Adequate	3	No change from existing condition.

Objective 6—Protect the Quality and Availability of Water (Medium Weight)

Criterion C6.3: In-stream Water Quality (40)

Rating guidance: Assesses water quality protection through vegetation and in-stream hydraulic complexity.

Outstanding: a) Alternative would likely improve in-stream water quality by creating a hydraulically complex channel and including native riparian vegetation (reference SCVWD-approved list) in appropriate locations to achieve significant benefits to water quality:
- Filter pollutants—protective buffer strip of low, brushy, grassy vegetation on banks and/or in floodplain to slow and filter overland flows.
- Moderate temperatures—near-stream or canopy-forming vegetation (shaded riverine aquatic).
- Stabilize the stream banks with (live) root mass.
- Provide aeration, shade, filtering, mixing and stream bank erosion protection through large- or small-scale hydraulic roughness elements (Scale refers to discrete in-channel features (small-scale), vs. configuration of channel itself (large-scale))
- Concentrate low flows within a smaller, defined channel to reduce stagnant water and maintain temperature, dissolved oxygen and provide vector control.

b) Vegetation system provides above values short-term and long-term after construction.

Adequate: a) Alternative would likely maintain current water quality conditions through the use of appropriate vegetation and hydraulically complex in-stream elements.
b) Vegetation would likely take more than five years to re-establish and provide water quality benefits.

Poor: Alternative would reduce streamside vegetation and in-stream hydraulic complexity as compared to existing conditions, likely resulting in a reduction in water quality.

Unacceptable: Alternative would provide no vegetation or would result in significant loss of streamside and buffer vegetation. Alternative would provide little or no hydraulic complexity to enhance aeration, shade or other water quality parameters.

Alternative	Rating	# Score	Comments
No project	Adequate	3	No change from existing condition.
1	Adequate	3	No substantial change from existing condition.
2A	Very good	4	Vegetated benches in Reaches 1 and 2 would filter pollutants. Complex channel in Reach 3 combined with future reduction in sediment removal will enhance water quality.
4	Outstanding	5	Vegetated benches in Reaches 1, 2 and 3 would filter pollutants. Complex channel in Reach 3 combined with future reduction in sediment removal will enhance water quality.
6	Unacceptable	0	Reduction in vegetation reduces filtering of pollutants. Channel lacks complexity.

Objective 6—Protect the Quality and Availability of Water (Medium Weight)

Criterion C6.4: Storm-Water Management (20)

Rating guidance: Assesses ability to enhance water supply and quality and reduce peak flows through local retention of rainfall and pollution prevention programs.

Outstanding: Significantly increases retention and use of rainwater where it falls (thereby improving local water availability and reducing potential for non-point source runoff/ overland flow); significantly reduces peak flows to the creeks (thereby reducing the need for flood protection); and
Incorporates programs or features that would result in a decrease of pollution potential.

Adequate: Alternative moderately or measurably increases retention and use of rainwater where it falls (thereby improving local water availability and reducing potential for non-point source runoff); and moderately or measurably reduces peak flows to the creeks (thereby reducing the need for flood protection).

Poor: Alternative does not contain any such elements.

Unacceptable: Alternative would discourage local capture of rainfall/runoff.

Alternative	Rating	# Score	Comments
No project	Poor	1	No elements to retain rainfall or prevent pollution.
1	Poor	1	No elements to retain rainfall or prevent pollution.
2A	Adequate	3	Vegetated benches in Reaches 1 and 2 would retain rainfall and filter pollutants.
4	Very Good	4	Vegetated benches in Reaches 1, 2 and 3 would retain rainfall and filter pollutants. Reach 3 bench is very large.
6	Unacceptable	0	Concrete lining inhibits capture of rainfall.

Objective 6—Protect the Quality and Availability of Water (Medium Weight)

Criterion C6.5: Flow Regime (20)

Rating guidance: Assesses ability to maintain geomorpholgically and biologically appropriate range of flows – quantity and timing.

Outstanding: Alternative maintains locally appropriate seasonal variation in flows that will support an appropriate physical channel configuration and habitat.

Adequate: Alternative includes modification to the locally appropriate flow regime with no significant impact on channel stability or habitat.

Poor: Alternative includes significant modifications to natural flow regime which is likely to have an impact on channel stability or habitat.

Unacceptable: Modifications to flow regime are likely to have a significant impact on channel stability or habitat.

Alternative	Rating	# Score	Comments
No project	Poor	1	Periodic sediment removal in Reaches 2, 3 and 4 would disrupt habitat and affect flows.
1	Poor	1	Periodic sediment removal in Reaches 2 and 4 would disrupt habitat and affect flows.
2A	Very Good	4	Improved channel stability. Avoids periodic disruption from sediment removal. Channel physical configuration and habitat complexity are best possible given right or way limitations.
4	Very Good	4	Improved channel stability. Avoids periodic disruption from sediment removal. Channel physical configuration and habitat complexity are best possible given right or way limitations.
6	Unacceptable	0	Natural elements removed. Increase concrete bed and bank linings will result in unnaturally flashy flows.

Objective 7—Cooperate with Other Local Agencies to Achieve Mutually Beneficial Goals (Medium Weight)

Criterion C7.1: Mutual Local Goals (50)

Rating guidance: Assesses ability to achieve the project-specific goals and objectives developed by the District and local agencies.

Outstanding: All goals and objectives developed in a Memorandum of Consensus (MOC) are met.

Adequate: Some goals and objectives developed in the MOC of all agencies are met.

Poor: MOC is developed but only District goals and objectives are met.

Unacceptable: Few objectives met, or no MOC developed.

Alternative	Rating	# Score	Comments
No project	Outstanding	5	Retains east and west bank recreational trails and avoids bridge work.
1	Very good	4	Facilitates east and west bank recreational trails and minimizes bridge work.
2A	Adequate	3	Facilitates east and west bank recreational trails but modifies California Circle and Milmont Drive bridges.
4	Fair	2	West bank trail would be on depressed maintenance road and thus provides lower quality user experience. Modifies California Circle and Milmont Drive bridges
6	Poor	1	Concrete-lined channel is aesthetically and environmentally disfavored.

Objective 7—Cooperate with Other Local Agencies to Achieve Mutually Beneficial Goals (Medium Weight)

Objective C7.2—Supports General Plan (50)

Rating guidance: Assesses ability to support goals and policies as stated in general plan of partner agencies.

Outstanding: Supports all applicable City of Milpitas General Plan policies

Adequate: Supports some, but not all, applicable City of Milpitas General Plan policies

Poor: Does not support some City of Milpitas General Plan policies and conflicts with some General Plan policies.
Unacceptable: Significant conflicts with major policies in City of Milpitas General Plan.

Criterion 2: Supports General Plan

Alternative	Rating	# Score	Comments
No project	Poor	1	Does not meet Policies 4.d G-1, 5.b G-1, or 5.b I-5.
1	Very Good	4	This alternative meets the following City of Milpitas Goals and Policies: • 4.a G-2: Develop diversified trail system along streamsides and other public right of ways to provide recreational opportunities and link facilities • 4.d G-1: Assure reasonable protection of beneficial uses of creeks and protect environmentally sensitive areas • 5.b G-1: Minimize threat to life and property from flooding 5.b I-5: Seek construction of flood control channel to withstand 100-year flood along Penitencia Creek. It supports east and west bank trails.
2A	Very Good	4	This meets City policies and goals 4a G-2, 5.b G-1, and 5.b I-5. It exceeds goal 4.d G-1 by increasing the amount of creekside vegetated area in Reaches 1 and 2. It supports east and west bank trails.
4	Adequate	3	This meets City policies and goals 4a G-2, 5.b G-1, and 5.b I-5. It greatly exceeds goal 4.d G-1 by greatly increasing the amount of creek-side vegetated area in Reaches 1, 2 and 3. The west bank trail would be of low quality due to its location on a depressed channel access road.
6	Poor	1	Although a small numbers of local residents expressed support for this alternative at the June 2014 public information meeting, this alternative reduces wetlands and

			riparian habitat and does not meet City Goal 4.d. G-1. This alternative meets City Goal 4.d G-2 and Policy 5.b. I-5. City Goal 4.a G-2 is nominally met because the east bank trail would be retained, but the quality of the recreational experience would be adversely affected by a mostly concrete creek channel.

Objective 8—Maximize Community Benefits beyond Flood Protection (Low Weight)

Criterion C8.1: Community Safety (20)

Rating guidance: Assesses overall safety for appropriate access and recreation.

Outstanding: All safety issues identified by public safety officials during their review are addressed.

Adequate: Most safety issues identified addressed. Project team provides explanation for features deemed inappropriate or infeasible

Poor: Few if any recommendations incorporated into the proposed alternative

Unacceptable: alternative was not reviewed by public safety officials to evaluate safety concerns.

Alternative	Rating	# Score	Comments
No project	Unacceptable	0	Not reviewed by public safety officials
1			
2A			
4			
6			

Objective 8— Maximize Community Benefits beyond Flood Protection (Low Weight)

Criterion C8.2: Recreation (20)

Rating guidance: Assesses quality of recreation experience provided by alternative.

Outstanding: Area provides unique, quality recreational opportunities or a variety of opportunities including active and passive recreation in an area that is otherwise lacking in similar recreational opportunities. Area is highly accessible to the public and provides related amenities. Facilities are incorporated into existing recreational facilities and the surrounding community.

Adequate: Some recreational facilities incorporated into alternative. Access may be limited.

Poor: Few or no recreational facilities incorporated into alternative.

Unacceptable: Existing recreational activities are removed as a result of the alternative.

Alternative	Rating	# Score	Comments
No project	Fair	3	Retains east bank recreational trail and Reach 2 boat launch ramp. No increase in channel vegetation results in little or no aesthetic improvement.
1	Fair	3	Retains east bank recreational trail and Reach 2 boat launch ramp. Minimal increase in channel vegetation results in little or no aesthetic improvement.
2A	Adequate	3	Retains east bank recreational trail and Reach 2 boat launch ramp. Increased vegetation in Reaches 1 and 2 improves aesthetics. Retains potential for recreational trail on west bank in Reaches 3 and 4
4	Fair	2	Retains east bank recreational trail and Reach 2 boat launch ramp. Increased vegetated area in Reach 3 improves aesthetics but this is offset by tall floodwall and increased graffiti potential. Reach 3 floodwall separates possible west bank trail from creek.
6	Fair	2	Retains east bank recreational trail and Reach 2 boat launch ramp, but reduction in vegetation and increased potential for graffiti diminish recreation quality.

Objective 8— Maximize Community Benefits beyond Flood Protection (Low Weight)

Criterion C8.3: Aesthetics (20)

Rating guidance: Assesses quality of aesthetic form provided by the alternative.

Outstanding: This is a qualitative assessment. Some features to consider include:
-Harmonizes with the landscape
- Emulates / creates natural environment including sound (birds, water); meander; smell (natural earth, water)
- Unexpected large / small features
- Concrete may be colored or sculpted to look like natural rock
- Park-like, natural-like
- Art, informal art, locally appropriate art
- Amenities—benches
- Clever
- Follows "Coyote Watershed Aesthetic Guidelines" for project features, as applicable (SCVWD, Dec 2000)

Unacceptable: Hardscape significantly greater than greenscape, visual monotony, heavy use of plain concrete.

Alternative	Rating	# Score	Comments
No project	Very good	4	No new floodwalls or increase in hardscape.
1	Fair	2	New concrete floodwalls in Reaches 2, 3 and 4, marginally offset by small new vegetated bench in Reach 2.
2A	Adequate	3	New concrete floodwalls in Reaches 2, 3 and 4 offset by new vegetated benches in Reaches 1 and 2.
4	Adequate	3	New concrete floodwalls in Reaches 2, 3 and 4 offset by new vegetated benches 1, 2 and 3. Concrete floodwall in Reach 3 would be about 18 ft tall and graffiti target.
6	Unacceptable	0	Significant increase in concrete results in unnatural and unaesthetic channel. Frequent sediment removal in Reaches 2, 3,and 4 prevents vegetation establishment.

Objective 8— Maximize Community Benefits beyond Flood Protection (Low Weight)

Criterion C8.4: Open Space (20)

Rating guidance: Assesses incorporation of open space into alternative design.

Outstanding: The alternative ensures continued long-term protection of existing protected open space.

- Alternative creates new open space.
- Alternative protects existing open space that is/will be subject to development in the near future, taking advantage of opportunities to provide open space in anticipation of future development pressures or anticipated local growth

Adequate: The alternative preserves existing open space within the project area.

Poor: Existing open space would be degraded by the alternative.

Unacceptable: Significant amount of existing open space would be lost.

Alternative	Rating	# Score	Comments
No project	Adequate	3	Existing open space preserved but no increase.
1	Adequate	3	Existing open space preserved but no increase.
2A	Very Good	4	New open space connected to creek created in reach 1 by relocating west bank levee farther from creek. Higher quality open space created in Reach 2 by converting grass slope to vegetated creek-side bench.
4	Outstanding	5	New open space connected to creek created in reach 1 by relocating west bank levee farther from creek. Higher quality open space created in Reach 2 by converting grass slope to vegetated creek-side bench. New open space in Reach 3 created by replacing west bank levee with floodwall and vegetated creek-side bench.
6	Poor	1	Existing open space preserved but degraded by being covered in concrete.

Objective 8— Maximize Community Benefits beyond Flood Protection (Low Weight)

Criterion C8.5: Community Input (20)

Rating guidance: Alternative reflects community-developed objectives/ideas.
Outstanding: Relative to other alternatives, community indicates overwhelming support.
Adequate: Overall, community indicates acceptance of this alternative relative to the other alternatives.
Poor: Community clearly indicates a lack of support for this alternative.

Unacceptable: Community finds this alternative unacceptable.

Alternative	Rating	# Score	Comments
No project	Fair	2	At the June 14, 2014 public information meeting, the public neither supported nor opposed this alternative. They expressed support for reducing flood risks, which this alternative does not achieve. They all supported preserving and/or improving the City recreational trail and maintaining the creek for aesthetics and ecological protection, which this alternative achieves.
1	Adequate	3	At the June 14, 2014 public information meeting, the public neither supported nor opposed this alternative. They expressed support for reducing flood risks, preserving and/or improving the City recreational trail, and maintaining the creek for aesthetics and ecological protection. This alternative meets the City of Milpitas Goals and Policies with respect to recreational trails (4.a G-2), flood protection (4.d G-1 and 5.b I-5), and ecological protection (4.d G-1).
2A	Adequate	3	Same as Alternative 1.
4	Adequate	3	Same as Alternative 1.
6	Fair	2	Although a small numbers of local residents expressed support for a concrete-lined channel at the June 14, 2014 public information meeting, their support was based on achieving maximum flood protection. All of the alternatives would protect against the 100-yr flood event; concrete-lined channel is not required to achieve this objective. This alternative reduces wetlands and riparian habitat and does not meet City Goal 4.d. G-1.

Objective 9—Minimize Life-Cycle Costs (Medium Weight)

Criterion C9.1: Capital Cost (50)

Rating Guidance: Criteria are not weighted - costs are simply added together in net present value.

The funding available for capital cost for this project is $20.0 million (2015 dollars)

Alternative	$NPV	Comments
No project	$0	
1	$10.92 M	
2A	$14.64 M	
4	$21.97 M	
6	$30.86 M	

Objective 9—Minimize Life-Cycle Costs (Medium Weight)

Criterion C9.2: Maintenance Cost (30)

Net Present Value of all maintenance costs over the life of the project (50 years)

Alternative	$NPV	Comments
No project	$12.74 M	
1	$9.6 M	
2A	$2.22 M	
4	$2.31 M	
6	$11.99	

Objective 9—Minimize Life-Cycle Costs (Medium Weight)		
Criterion C9.3: Grant or Cost-Sharing Opportunities (20) Net Present Value of grant or cost sharing opportunities for project or project components		
Alternative	**$NPV**	**Comments**
No project	0	
1		
2A		
4		
6		

Objective 10—Impacts are Avoided , Minimized or Mitigated (Medium Weight)

Criterion C10.1: Compliance with San Francisco Bay Basin Plan (50)

Rating guidance: Assesses potential effects of each project alternative on water quality via conformance with the Basin Plan adopted by the Regional Water Quality Control Board. The SF Bay Basin Plan designates the following beneficial uses for Lower Penitencia Creek:

- Warm freshwater habitat (Warm)
- Wildlife habitat (Wild)
- Water contact recreation (Rec-1)
- Noncontact water recreation (Rec-2)

Outstanding: Alternative will enhance or improve one or more existing or potential beneficial uses and will not impair or harm any beneficial uses designated by the SF RWQCB.

Adequate: Project Alternative will have only minor adverse effects on existing or potential beneficial uses for the water body designated by the RWQCB, and minor effects on existing or potential beneficial uses can be minimized and/or feasibly mitigated.

Poor: Alternative will have potentially significant adverse effects on two or more existing or potential beneficial uses for the water body designated by the RWQCB, and mitigation for adverse effects to beneficial use(s) will be technically difficult, excessively expensive, or will only partially compensate for harm.

Inadequate: Alternative will have potentially adverse effects on existing or potential beneficial uses for the water body designated by the RWQCB, and mitigation for the harm to beneficial use(s) is not feasible.

Alternative	Rating	# Score	Comments
No project	Adequate	3	No change from existing condition. Retains Reach 2 boat ramp and east bank recreational trail.
1	Adequate	3	No change from existing condition. Retains Reach 2 boat ramp and east bank recreational trail.
2A	Very good	4	Reach 1 and 2 vegetated benches improve wildlife habitat and water quality. Retains Reach 2 boat ramp and east bank recreational trail.
4	Very good	4	Reach 1, 2 and 3 vegetated benches improve wildlife habitat and water quality. Alternative has greatest amount of vegetated habitat. Retains Reach 2 boat ramp and east bank recreational trail.
6	Unacceptable	0	Concrete lined channel has no habitat value, increases water temperature, and adversely affects water quality. Retains Reach 2 boat ramp and east bank recreational trail but poor aesthetics detracts from quality of water-contact and non-contact recreation.

Objective 10— Impacts Are Avoided , Minimized or Mitigated (Medium Weight)

Criterion C10.2: Identify the Least Environmentally Damaging Practicable Alternative (LEDPA) (50)

Rating guidance: Determines the preliminary LEDPA and ensures it is carried forward. The Alternative with the highest C10.2 score is the preliminary LEDPA. The RWQCB and USACE will issue Clean Water section 401 and 404 approvals only to the Alternative that is the LEDPA. It is acceptable to carry forward to the planning phase alternatives that are not the preliminary LEDPA (future design revisions may change which alternative is the LEDPA), but the preliminary LEDPA must be one of the project alternatives carried forward to the next phase.

Outstanding: Alternative avoids all adverse effects on environmental resources.

Very Good: Alternative avoids and/or minimizes all effects on environmental resources, and alternative (without mitigation) will not result in significant adverse environmental effects.

Adequate: Project Alternative will result in potentially significant adverse effects to environmental resources, and feasible mitigation measures will reduce the significance of adverse environmental effects to less than significant levels.

Poor: Alternative will result in potentially significant adverse effects to environmental resources, and Mitigation for adverse effects to beneficial use(s) is infeasible or will be technically difficult or excessively expensive.

Alternative	Rating	# Score	Comments
No project	Poor	1	Future sediment removal will periodically disrupt creek bed habitat in Reaches 2, 3 and 4.
1	Fair	2	Future sediment removal will periodically disrupt creek bed habitat in Reaches 2 and 4. Vegetated bench in Reach 2 will somewhat increase wildlife habitat.
2A	Adequate	3	Minimizes need for future sediment removal. Vegetated benches in Reaches 1 and 2 provide increased habitat, which offsets adverse effect of new center pier for California Circle Bridge.
4	Adequate	3	Minimizes need for future sediment removal. Vegetated benches in Reaches 1, 2 and 3 increases habitat to greater extent than Alternative 2A. Tall floodwall and adjoining depressed maintenance road in Reach 3 increase in-channel hardscape compare to Alternative 2A. Milmont Drive widening results in construction-period disruption of channel. This alternative adds 2 bridge piers compared to 1 for alternative 2A.
6	Poor	1	Future sediment removal will periodically disrupt creek bed habitat in Reaches 2, 3 and 4. Concrete lining in Reaches 1, 2 and 3 will increase water temperature and decrease water quality. Permanently removes riparian habitat on center island in Reach 3.

Lower Penitencia Creek

Alternatives Workshop Natural Flood Protection (NFP) Summary Ratings

(5) Outstanding (4) Very Good (3) Adequate (2) Fair (1) Poor (0) Unacceptable

Alternatives	Objective										
	Protection from flood damage (High weight)	Watershed Context (High Weight)	Ecology (Medium Weight)	Geomorphology (Medium Weight)	Maintenance (High Weight)	Water Quality & Availability (Medium Weight)	Other Agency Support (Medium Weight)	Community Benefits (Low Weight)	Life-Cycle Costs (Medium Weight)	LEDPA (Medium Weight)	Total NFP Points
Alternative 1	2.7	4.0	2	1.95	1.25	2.7	4	2.2	4	2.5	60.4
Alternative 2A	3.1	4.0	3.75	4.0	2.0	3.35	3.5	2.6	5	3.5	76.1
Alternative 4	3.0	3.0	4.75	4.45	2.25	3.75	2.5	2.6	3	3.5	71.3
Alternative 6	3.2	1.0	0.5	1.3	1.5	0.75	1	1	1	0.5	28.2

Rating Guidance for each criteria:
Refer to document ID: WW75125—Guidance on Alternative Selection & Evaluation for Natural Flood Protection Projects Revision R3
Weights:
High Weight=3, Medium Weight=2, Low Weight= 1
Life-Cycle Cost
Land acquisition for Alt 2A & Alt 4 has not been determined yet

Lower Pen Creek

Objective Rating Matrix

Objective 1: Provide protection from flood damage

(5) Outstanding | (4) Very Good | (3) Adequate | (2) Fair | (1) Poor | X (0) Unacceptable

Alternative	Criteria and Weights						Summary Rating
	Safety (30)	Economics Protection (30)	Durability (10)	Resiliency (10)	Local Drainage (10)	Time to Implementation (10)	
Alternative 1	(2) Fair	(3) Adequate	(3) Adequate	(2) Fair	(3) Adequate	(4) Very Good	(3) Adequate 2.7
Alternative 2A	(3) Adequate	(3) Adequate	(4) Very Good	(4) Very Good	(3) Adequate	(2) Fair	(3) Adequate 3.1
Alternative 4	(3) Adequate	(3) Adequate	(4) Very Good	(4) Very Good	(3) Adequate	(1) Poor	(3) Adequate 3.0
Alternative 6	(3) Adequate	(4) Very Good	(3) Adequate	(2) Fair	(3) Adequate	(3) Adequate	(3) Adequate 3.2

Rating Guidance for each criteria:

Refer to document ID: WW75125—Guidance on Alternative Selection & Evaluation for Natural Flood Protection Projects Revision R3

Lowe Pen Creek

Objective Rating Matrix

Objective 2: Integrate Within The Watershed		
(5) Outstanding	(4) Very Good	(3) Adequate
(2) Fair	(1) Poor	X (0) Unacceptable

Alternative	Criteria and Weights	Summary Rating
	Meets Local Watershed Goals (100)	
Alternative 1		4
Alternative 2A		4
Alternative 4		3
Alternative 6		1

Rating Guidance for each criteria:

Refer to document ID: WW75125—Guidance on Alternative Selection & Evaluation for Natural Flood Protection Projects Revision R3

Lower Pen Creek

Objective Rating Matrix

Objective 3: Support Ecologic Functions and Processes

(5) Outstanding | (4) Very Good | (3) Adequate | (2) | (1) Poor | X (0) Unacceptable

Alternative	Criteria and Weights				Summary Rating
	Meets Local Habitat Goals (25)	Habitat Provided (25)	Sustainability of Habitat (25)	Connectivity of Habitat (25)	
Alternative 1					2
Alternative 2A					3.75
Alternative 4					4.75
Alternative 6	X	X			0.5

Rating Guidance for each criteria:
Refer to document ID: WW75125—Guidance on Alternative Selection & Evaluation for Natural Flood Protection Projects Revision R3
Numeric rating:

If the numeric summary rating is between 2 rating (e.g. 3.5 which is between very good and adequate) the asigned rating will be the lowest rating

Lower Pen Creek

Objective Rating Matrix

Objective 4: Integrate Geomorphic Physical Stream Function and Processes

(5) Outstanding | (4) Very Good | (3) Adequate | (2) Fair | (1) Poor | X (0)Unacceptable

Alternative	Criteria and Weights				Summary Rating
	Floodplain (35)	Active Channel (30)	Stable Side Slopes (20)	Transitions (15)	
Alternative 1	(2) Fair	(2) Fair	(1) Poor	(3) Adequate	(2) Fair 1.95
Alternative 2A	(4) Very Good	(4) Very Good	(4) Very Good	(4) Very Good	(4) Very Good 4.0
Alternative 4	(5) Outstanding	(5) Outstanding	(3) Adequate	(4) Very Good	(4) Very Good 4.45
Alternative 6	(1) Poor	(1) Poor	(1) Poor	(3) Adequate	(1) Poor 1.3

Rating Guidance for each criteria:

Refer to document ID: WW75125—Guidance on Alternative Selection & Evaluation for Natural Flood Protection Projects Revision R3

Lower Pen Creek

Objective Rating Matrix

Objective 5: Minimize Maintenance Requirement

(5) Outstanding | (4) Very Good | (3) Adequate | (2) Fair | (1) Poor | X (0) Unacceptable

Alternative	Criteria and Weights				Summary Rating
	Structural Features (25)	Natural Processes (25)	Urban Flows (25)	Access (25)	
Alternative 1	X	(1)	(1)	(3)	(1) 1.25
Alternative 2A	X	(4)	(1)	(3)	(2) 2.0
Alternative 4	X	(5)	(1)	(3)	(2) 2.25
Alternative 6	X	(1)	(1)	(4)	(1) 1.5

Rating Guidance for each criteria:

Refer to document ID: WW75125—Guidance on Alternative Selection & Evaluation for Natural Flood Protection Projects Revision R3

Numeric rating:

If the numeric summary rating is between 2 rating (e.g. 3.5 which is between very good and adequate) the asigned rating will be the lowest rating

Lower Pen Creek

Objective Rating Matrix

Objective 6: Protect the Quality and Availability of Water

(5) Outstanding | (4) Very Good | (3) Adequate | (2) Fair | (1) Poor | X (0) Unacceptable

Alternative	Criteria and Weights					Summary Rating
	Water Availability (30)	Groundwater Quality (25)	Instram Water Quality (30)	Offstream Water Management (10)	Flow Regime (5)	
Alternative 1						2.7
Alternative 2A						3.35
Alternative 4						3.75
Alternative 6	X		X	X	X	0.75

Rating Guidance for each criteria:

Refer to document ID: WW75125—Guidance on Alternative Selection & Evaluation for Natural Flood Protection Projects Revision R3

Lower Pen Creek

Objective Rating Matrix

Objective 7: Cooperate With Other Local Agencies to Achieve Mutually Beneficial Goals					
(5) Outstanding	(4) Very Good	(3) Adequate	(2) Fair	(1) Poor	X (0) Unacceptable

Alternative	Criteria and Weights		Summary Rating
	Mutual Local Goals (50)	Supports General Plan (50)	
Alternative 1			4.0
Alternative 2A			3.5
Alternative 4			2.5
Alternative 6			1.0

Rating Guidance for each criteria:

Refer to document ID: WW75125—Guidance on Alternative Selection & Evaluation for Natural Flood Protection Projects Revision R3

Numeric rating:

If the numeric summary rating is between 2 rating (e.g. 3.5 which is between very good and adequate) the asigned rating will be the lowest rating

Lower Pen Creek

Objective Rating Matrix

Objective 8: Community Benefits Beyond Flood Protection

(5) Outstanding (4) Very Good (3) Adequate (2) Fair (1) Poor X (0) Unacceptable

Alternative	Criteria and Weights					Summary Rating
	Community Safety (20)	Recreation (20)	Aesthetices (20)	Open Space (20)	Community Support (20)	
Alternative 1	X					2.2
Alternative 2A	X					2.6
Alternative 4	X					2.6
Alternative 6	X		X			1.0

Rating Guidance for each criteria:

Refer to document ID: WW75125—Guidance on Alternative Selection & Evaluation for Natural Flood Protection Projects Revision R3

Lower Pen Creek

Objective Rating Matrix

Objective 9: Minimize Life-Cycle Costs

(5) Outstanding (4) Very Good (3) Adequate (2) Fair (1) Poor X (0) Unacceptable

Alternative	Criteria and Weights			Summary Rating
	Capital Cost	Maintenance Cost	Grant or Cost-sharing Opportunities	
Alternative 1	$10.92	$9.60	0	$20.52
Alternative 2A	$14.64	$2.22	0	$16.86
Alternative 4	$21.97	$2.31	0	$24.28
Alternative 6	$30.86	$11.99	0	$42.85

Rating Guidance for each criteria:

Refer to document ID: WW75125—Guidance on Alternative Selection & Evaluation for Natural Flood Protection Projects Revision R3

Lower Pen Creek

Objective Rating Matrix

Objective 10: Impacts Are Avoided, Minimized or Mitigated					
(5) Outstanding	(4) Very Good	(3) Adequate	(2) Fair	(1) Poor	X (0) Unacceptable

Alternative	Criteria and Weights		Summary Rating
	Water Quality Effect (50)	LEDPA (50)	
Alternative 1			2.5
Alternative 2A			3.5
Alternative 4			3.5
Alternative 6	X		X 0.5

Rating Guidance for each criteria:

Refer to document ID: WW75125—Guidance on Alternative Selection & Evaluation for Natural Flood Protection Projects Revision R3

Numeric rating:

If the numeric summary rating is between 2 rating (e.g. 3.5 which is between very good and adequate) the asigned rating will be the lowest rating

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